L. E. Carpenter and Company

Revised Workplan for Delineating and Characterizing Elevated Lead Concentrations in Soil

Final

Prepared by
RMT, Inc.
May 2001

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REVISED WORKPLAN FOR DELINEATING AND CHARACTERIZING ELEVATED LEAD CONCENTRATIONS IN SOIL

PREPARED FOR
L.E. CARPENTER AND COMPANY
WHARTON, NEW JERSEY
USEPA ID #NJ002168748

May 2001

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Section 1
Introduction

1.1 Background

The L.E. Carpenter (LEC) site is located at 170 North Main St., Borough of Wharton, Morris County, New Jersey (Figure 1). The site history has been summarized in numerous reports including, but not limited to, the *1992 Final Supplemental Remedial Investigation Addendum Report* (Weston, 1992a), the *Evaluation of Remediation of Groundwater by Natural Attenuation Report* (RMT, 2000a), the agency approved workplan for *Further Off-Site Groundwater Investigation at MW19/Hot Spot 1* (RMT, 2000c), and is summarized briefly here.

The site had an operating iron mine and forge from the late 1800's to the early 1900's. Subsequently, the site was operated as a manufacturing facility for vinyl wall coverings from 1943 to 1987, and primarily as a warehouse (eastern portion of the site only) since 1987. An Administrative Consent Order (ACO) was entered into with the NJDEP in 1982, followed by a 1983 Addendum, and a 1986 additional ACO.

Site remediation activities began in 1982, and have included, but are not limited to, the removal of 4,000 cubic yards of sludge and soil from the former surface impoundment, excavation and backfilling of the starch drying beds, the removal of aboveground and underground storage tanks and associated piping, the demolition and removal of various facility structures located on the eastern portion of the site, and the recovery of Light Non-Aqueous Phase Liquid (LNAPL or free product). A site features map is presented as Figure 2.

RMT, Inc. (RMT) prepared this Revised Workplan on behalf of LEC to delineate and characterize elevated lead concentrations in soil at the LEC property. LEC originally agreed to submit a Workplan during a telephone conference that took place on July 31, 2000. Subsequently, RMT prepared and submitted to the NJDEP the document entitled *Workplan for Delineating and Characterizing Elevated Lead Concentrations in Soil* (September 6, 2000). That Workplan addressed concerns outlined in the NJDEP letters dated April 13, 2000, and August 1, 2000, and those discussed during the July 31, 2000 teleconference.

The NJDEP and US EPA reviewed the September 6, 2000 Workplan and forwarded LEC their comments in a letter dated December 21, 2000. This Revised Workplan has been completed in response to the December 21, 2000 letter.

1.2 Project Objectives

The presence of elevated lead concentrations on this site demands that the nature and extent of the lead be fully characterized such that any potential risks can be addressed. The specific objectives of this investigation are, therefore, to:

- fully delineate the horizontal and vertical extent of lead concentrations in the soil and groundwater;
- determine the potential source(s) of the elevated lead concentrations;
- provide data necessary to fill data-gaps that may exist in the Weston human health risk assessment;
- determine if any further ecological risk assessments are necessary; and
- lay the groundwork for and provide data necessary to complete a focussed feasibility study that will determine what remedial actions may be necessary, if any.

Accomplishing these objectives requires distinct but coordinated field, laboratory and analysis tasks. These tasks are outlined in Section 2 of the Workplan, along with the rationale, discussions and data quality objectives supporting the scope of work proposed. The appendices and attachments to this Workplan include a detailed Quality Assurance Project Plan (QAPP) and standard operating procedures (SOPs) for work to be performed.

1.3 Data Quality Objectives

The overall data quality objectives for soil sampling to accomplish project objectives are summarized in Table 2. Details regarding the objectives are presented in Section 2 and on Figure 3. Details on groundwater wells sampling locations are presented in Table 1 and on Figure 2.

Section 2
Scope of Work

2.1 Delineation of Lead Distribution

2.1.1 Past Evaluations

LEC has investigated soil and groundwater conditions at the site since 1986. RMT and Weston collected and tested about 120 soil samples from over 100 locations and at various depths. These data show that soil lead concentrations above the target cleanup level (600 mg/kg) exist at several locations on the LEC property. The data also show that lead at varying levels is ubiquitous across the site. The average abundance of lead in the earth's crust is about 12 ppm. This value is similar to the average lead found in soils included in a background soil survey of New Jersey (NJDEP, 1993), which ranges from 14 to 22 ppm (includes farm, golf, rural, and suburban settings). In contrast, soil lead concentrations at the LEC site are commonly more than 100 ppm (Figure 3). Such a widespread distribution would more appropriately match a source related to the geological and mining history of the site rather than point sources and surficial discharges related to LEC manufacturing operations. In addition, there are no known sources of lead that have been identified to date related to the LEC manufacturing process.

Weston reportedly excavated lead-impacted soils from the Former Waste Disposal area and removed them from the site. Soils that Weston excavated from Hot Spots A, B, C, and D were reportedly stockpiled around the former Building 14 footprint (see area labeled as "4-foot soil pile" on Figure 3). The area containing the most samples showing lead in excess of the 600 mg/kg cleanup level is near and around former LEC Building 14, mostly within and immediately adjacent to the stockpiled soil (Figure 3).

The vertical and horizontal extent of lead concentrations above 600 mg/kg is currently undefined at some locations. Completion of the site investigation described below is designed to bridge the delineation data-gaps and provide data necessary to perform additional evaluation of human health risks.

2.1.2 Rationale

RMT will implement an aggressive, real-time approach to sampling that will accomplish the investigation goals in one mobilization. Inasmuch as elevated lead values have been

extensively documented in the area surrounding Building 14. RMT will begin lead delineation efforts in the Building 14 area and work radially outward, via a series of transects covering the breadth of the site. We will first evaluate the horizontal extent of lead in the shallow soils using X-Ray Fluorescence (XRF) field screening methods. Then, using a subset of the resulting XRF and confirmatory laboratory lead data, we will investigate the vertical extent of lead in the deeper soils. Additional subsets of samples containing the highest elevated levels of lead will be tested to evaluate leaching and mineralogic characteristics.

2.1.3 Horizontal Lead Delineation

Initial sampling points located along each radial transect are identified on Figure 3. The suggested sampling locations are spaced approximately 50 feet apart along each transect. A total of 60 shallow soil samples (0-6 inches below grade) will be collected and analyzed for lead using the XRF (Niton XL-700 or equivalent). Each sample will be collected with a clean, stainless steel hand trowel/spoon, mixed thoroughly, and placed into a plastic bag for XRF analysis of lead.

To achieve the highest degree of accuracy, sample grain-size must be less than or equal to 2mm (passing through a #10 sieve). When required, we will mechanically crush coarse-grained (>2mm) samples using a mortar and pestle or rotary grinder before placing them into the plastic bag. We will obtain and record at least three XRF readings for each sample and calculate an average concentration. Averaging several readings minimizes the error associated with small-scale variability. One-third of the samples (total of 20) will be submitted to a certified laboratory for confirmatory purposes for the analysis of lead in accordance with the QAPP (Appendix A). Out of these 20 samples, approximately six samples will consist of soils with the lowest concentrations of total lead, and other 14 will consist of soils with relatively higher levels of total lead.

2.1.4 Vertical Lead Delineation

Upon completion of the shallow soil sampling, both the XRF and laboratory data will be compiled and analyzed to determine which horizontal sampling locations will be further investigated. Using the compiled lead data from the shallow sampling event, a subset of 30 locations will be selected for vertical lead profiling. These locations will represent the 30 most elevated concentrations of lead detected in the shallow soils.

At each of the 30 locations, test pits will be excavated using a backhoe to a maximum depth of ten feet below grade, or until groundwater is encountered. In areas known to contain free product (see Figure 3), test pits will be excavated to a maximum depth of

two feet above the water table. This depth will be determined in the field, prior to initiating the excavation activities, by collecting water level data from the surrounding monitoring wells. By remaining two feet above the water table, the vadose smear zone associated with the free product can potentially be avoided. This will help to minimize the volume of investigation-derived waste generated for off-site disposal. No test pit will extend vertically beyond the water table.

Soil samples will be collected at two discrete intervals in each test pit. Sampling intervals will include the lowermost one-foot and the mid-point of each test pit. Each sample will be collected with a clean, stainless steel hand trowel/spoon, mixed thoroughly, and placed into a plastic bag for XRF analysis of lead.

To achieve the highest degree of accuracy, sample grain-size must be less than or equal to 2mm (passing through a #10 sieve). When required, we will mechanically crush coarse-grained (>2mm) samples using a mortar and pestle or rotary grinder before placing them into the plastic bag. We will obtain and record at least three XRF readings for each sample and calculate an average concentration. Averaging several readings minimizes the error associated with small-scale variability. Confirmatory samples will be submitted to the laboratory for lead analysis, in accordance to the QAPP (Appendix A). RMT will submit one third of the samples analyzed using the XRF to an analytical laboratory for total lead analysis. We will also test confirmatory samples for total organic carbon (TOC) to assist in the risk assessment. Results from the XRF and laboratory analyses will provide data for the risk analysis described later in this Workplan.

2.1.5 Background Soil Sampling

RMT will collect soil samples from up to five background areas located within one mile of the LEC site. The exact locations will be selected in the field. One location will be in the general vicinity of the Orchard Mine. The other locations may include nearby parks, recreation areas, or school playing fields. By selecting off-site sampling locations, the potential for encountering non-native sediments can be minimized.

Samples will be collected at two discrete intervals (0-6 inches, 24-30 inches) using a hand auger or slide-hammer sampler. All equipment will be properly decontaminated between each sampling location. Each sample will be properly prepared and analyzed by an XRF to determine lead concentrations in the same manner as detailed above. We will submit all background samples to a laboratory for total lead analyses, and use the results to help evaluate the source of lead present in soil.

2.2 Analysis of Lead Sources

2.2.1 Previous Source Investigations

The widespread distribution of on-site lead is more appropriately matched to an anthropogenic source such as mining spoils rather than industrial point sources. Weston previously submitted references and documentation showing that mining occurred directly on the LEC property in their September 1992 report *Final Supplemental Remedial Investigation Addendum for L.E. Carpenter and Company*. In addition, Sanborn Fire Insurance Maps were also included in the 1992 report that showed some of the extensive history and uses of the various manufacturing buildings. RMT has synthesized relevant information from that report and other references into this Workplan (Figure 2). The information previously provided is clear-cut evidence that the LEC site has had a long history of usage, including mining and other types of manufacturing. Nevertheless, the source for the elevated lead detected in soil at the LEC property is still unclear, and there are no known sources of lead that have been identified to date related to the LEC manufacturing process.

2.2.2 Site History and Lead Source(s)

Understanding the source of the lead detected in site soil is important from the standpoint of determining risk and for identifying liability. RMT will use both historical and analytical methods in our attempt to identify the source(s) for the elevated lead concentrations.

Historically, we know that the property has been utilized for both industrial and mining operations since at least the late 1700s. Early development of Morris County was a direct result of the presence of iron ore deposits exposed at the surface throughout the County. The Dover district was providing iron ore as long ago as 1710, when both the Mt. Hope mine (three miles northeast of the LEC property) and Dickerson mine (three miles southwest of the LEC property) were in operation (Sims, 1958). A smelting furnace for converting iron ore into bar iron was built at Dover in 1722 (the John Jackson forge). The Washington Forge was built in about 1795 (W.W. Munsell & Co., 1882). The Washington Forge was located on the current LEC property (NJDOL, 1989). Because construction of the Washington Forge pre-dates development of the on-site mines (described below), iron ores from other nearby deposits would have been transported to the site for use in the forge (especially the Dickerson and Mt. Hope mines).

According to a New Jersey Department of Labor publication (NJDOL, 1989), the Washington Forge Mine and West Mount Pleasant Mine are located "in the L.E.

Carpenter lot." The NJDOL report states that the Washington Forge Mine opened in 1868 with the construction of two inclined shafts 20 feet apart on the grounds of the old forge. The mine was actively worked until 1875 when it was closed because of the difficulty in handling groundwater seepage into the mine (Bayley, 1910). The mine reportedly opened again in 1879 after a drainage tunnel to the Orchard Mine was completed. The Orchard Mine was located across the Rockaway River from the LEC site (Figure 1). The Washington Forge Mine was permanently abandoned in 1881. The West Mt. Pleasant Mine connects with the Washington Forge Mine with an inclined access shaft located about 170 feet northeast of the southern-most Washington Forge mine shaft (Figure 2). Neither the Bayley or Sims reports indicate when the West Mount Pleasant Mine was closed. The known iron ore production for the Wharton area is reported to be about 2,250,000 tons (NJDOL, 1989). Sims (1958) estimates a total production of 50,000 tons from the Washington Forge Mine; the total production from the West Mount Pleasant Mine is unknown.

RMT superimposed the location of the mines on the site map (Figure 2) based on a United States Geological Survey map contained in the *Geology and Magnetite Deposits of Dover District, Morris County, New Jersey* (Sims, 1958). Maps showing the inclined shaft entrance locations are provided in all three references (Bayley, Sims, and NJDOL). Although the mineshaft locations are slightly different in each publication, all agree that the mine entrances were located between North Main Street and the railroad tracks. The iron forge and mining history described above clearly shows that:

- Iron ore deposits exist in the subsurface in both the bedrock and unconsolidated glacial deposits directly below the LEC property.
- Iron smelting operations occurred directly on the LEC property beginning in the late 1700's.
- Iron ores from various Morris County locations other than the on-site mines were transported onto the LEC property for processing.
- Iron mining and smelting operations occurred on-site over a period of at least 86 years (1795–1881).

The history noted here points to several possible sources for the lead, some of which may indicate natural occurring minerals as the source. A sample of ore from the Washington Forge Mine was tested and the results presented in Bayley (1910) show that 0.245% sulfur was present in the ore sample. Naturally occurring lead is often associated with sulfide mineralization, and thus could be associated with on-site ore deposits and/or tailings. Magnetic concentrators are known to have been present at the Orchard Mine. These concentrators would separate magnetite from other ore by-products, and undoubtedly would have enriched the tailings discarded in the area with

gangue minerals associated with the magnetite ore (such as lead-bearing sulfide minerals like galena, pyrite, chalcopyrite, and pyrrohtite).

LEC owned and operated the facility from 1943 through 1987. LEC designed and manufactured vinyl wall coverings. Potential sources of lead from the LEC operation have not been identified. Silk and hosiery manufacturing operations took place on the LEC property before LEC began operations.

2.2.3 Historical Approach

RMT will attempt to gather more process information regarding the site and will include our analysis of available Sanborn maps in the final lead-investigation report. We have incorporated select information from some of these maps on Figure 2. LEC Building 14, which centers on the area with the highest soil lead concentrations, was built between 1916 and 1927, and originally operated as a hosiery manufacturing company.

2.2.4 Analytical Approach

Field Sampling - RMT will attempt to more accurately identify the lead source(s) present on the LEC property. Approximately ten soil samples will be collected from five test pits excavated to a depth of five feet below grade. These test pits will be generally located in the area surrounding Building 14, because of the documented presence of lead in this area. Approximate sampling locations are identified on Figure 3. Samples will be collected from two discrete intervals (0-1 foot, 4-5 feet). Each sample will first be evaluated visually using a binocular microscope and hand lens. If portions of the sample contain material that resembles ore or associated mineralogical suites (such as sulfide minerals) the material will be broadly classified as ore tailings. Alternatively, if the physical characteristics of the soil sample do not resemble ore, it will be classified in terms of its rock fragment and mineral assemblage (if possible), visual-manual soil classification, or as unknown.

All samples will be physically described and logged and all known minerals will be identified (if possible). Each sample will then be homogenized and split into two equal portions. One portion will be placed in a laboratory-supplied container for storage, the other will be placed into a plastic bag for X-Ray Fluorescence (XRF) analysis. We will use a Niton XL-700 Series XRF, or product equivalent, to complete these analyses.

Depending upon the grain-size distribution of each XRF sample, we may separate it into fine-grained (<2mm) and coarse-grained (>2mm) aliquots. Additional aliquots may be prepared if portions of a sample consist of identifiable ore material or metallic minerals. We will then mechanically crush the coarse-grained aliquot using a mortar and pestle or

rotary grinder, such that particles pass through a #10 sieve, before analyzing them with the XRF. We will obtain and record at least three XRF readings for each sample (if possible, depending on aliquot size) and calculate an average concentration. Averaging several readings minimizes the error associated with small-scale variability. Confirmatory samples will be submitted to a Certified Laboratory for analysis in accordance to the QAPP.

Statistical Analysis - XRF and laboratory data collected from all investigations will be analyzed using log-normal distribution plots to determine if one or more statistically viable populations (including background) exist on the site. They will also be evaluated to determine if the lead detection trends are biased toward specific site locations and/or samples that were first classified as ore tailings or unknown.

Petrographic Analysis - We will prepare thin-sections of select samples that are found to contain elevated levels (>600 ppm) of lead if we cannot adequately identify specific sample attributes using a binocular microscope. We will use the remaining portion of the sample that was previously contained in a separate jar. Thin-sections will be prepared by grinding the sample to an acceptable size, then compositing and fixing it onto a glass slide with epoxy. Other thin-sections of rock samples may be prepared using a traditional rock-saw and polishing device. These thin-sections will then be analyzed with a petrographic microscope.

By analyzing the samples in thin-section, we will be able to more effectively document the presence or absence of ore minerals that were too small to see with a binocular microscope. If RMT identifies naturally occurring minerals containing lead, we will estimate the approximate percent present. If thin-section analyses do not show that ore minerals are present across the site, that potential source for lead may be ruled out.

2.3 Assessment of Risk

2.3.1 Previous Assessment

Weston previously completed and submitted an extensive *Baseline Risk Assessment L.E. Carpenter and Company, Wharton, New Jersey (Draft Report)* (Weston 1992b). The 1992 Weston report includes human health evaluation exposure, toxicity, and ecological risk assessments, and overall risk characterization of the LEC site.

2.3.2 Additional Field Investigation

Leachability Testing - RMT will collect and submit six composite samples of soils with elevated lead (based on field XRF data) to the laboratory for SPLP lead testing. SPLP

data will supplement the groundwater data to evaluate the potential for lead to mobilize via rainfall infiltration into shallow groundwater. We will collect three of the composite samples from the area of stockpiled soils located along former footprint of Building 14. The locations of the remaining three composite samples will be outside of the stockpiled soil area. Each of the remaining locations will be based on elevated lead levels (>600ppm), using the XRF field data collected during the horizontal lead delineation.

Groundwater Sampling- RMT will obtain groundwater samples from 29 monitoring wells as shown on Figure 2. Construction details on these monitors are listed in Table 1. Low-flow sampling methods as outlined in Attachment 1 of the QAPP will be used to sample the wells. One filtered and one unfiltered sample will be collected from each well and analyzed for total and dissolved lead respectively. These samples may be collected during a regular quarterly sampling event, depending on schedule. Sampling protocols used will be consistent with those quarterly sampling procedures and according to the QAPP contained in Appendix A.

2.3.3 Focused Risk Assessment

Upon completion of the lead delineation, leachability and groundwater sampling efforts outlined above, RMT will determine if additional risk assessment for the groundwater pathway is warranted. Our lead delineation will provide sufficient data coverage to be properly incorporated into the lead risk model utilized to evaluate dermal and inhalation risks. At a minimum, we will conduct a focused risk assessment (RA) in accordance with guidance presented in the EPA document *Recommendations of the Technical Review Workgroup for an Interim Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil* (USEPA, December 1996). The results of the RA will be incorporated into the analysis of remedial alternatives.

2.4 Evaluation of Alternatives

Upon completing the first three tasks described above, RMT will evaluate remedial alternatives for the LEC site. If the data collected during this investigation verify that excavation and off-site disposal of lead-impacted soils is not a viable option, we will explore other remedial possibilities. We will use existing data, data collected during the site investigation, the results of the risk analysis, and historical information to develop options for leaving soils on site. These options will include no action and capping with a clean soil or asphalt cover. However, if circumstances prevent a soil or asphalt capping remedy, additional remedial options will be considered.

2.5 Investigation-Derived Wastes

Excavated soils will be temporarily stockpiled on plastic, and will be returned to each test pit upon completion of the sampling, photographic, and stratigraphic evaluation is complete. In the event we encounter soils that have been impacted by DEHP or VOCs (i.e. soils within the vadose smear-zone), care will be taken to properly dispose of the impacted soils at an approved off-site facility. All decontamination waters will be properly contained and temporarily stored on-site until they can be properly disposed of at an off-site facility. All sampling gloves, tyvek, etc. will be double-bagged and disposed of on-site in a municipal waste dispenser.

2.6 Sampling & Decontamination Protocol

Individual soil samples will be collected and handled using a new pair of disposable latex gloves, or product equivalent. Three sets of sampling trowels/spoons will be available to collect samples for each location. All sampling and excavation equipment (ex. trowels, spoons, backhoe bucket) will be properly decontaminated using a pressurized steam-cleaner and allowed to air dry between each sample location.

Section 3
Schedule

RMT will initiate the scope of work described in this Workplan within one month of receipt of the written NJDEP/EPA approval of this workplan. The time estimated to complete each of the major components of the Workplan is presented below. There will be an overlap of time for some field operations and report preparation.

■ Notify Laboratory and Subcontract Excavator	2 weeks
■ Sample monitoring wells	1 to 3 weeks
■ Perform Horizontal Delineation Sampling	1 week
■ Perform Vertical Delineation Sampling	2 weeks
■ Analyze chemical parameters in certified laboratory	3 weeks
■ Verify laboratory data, and begin report preparation	2 weeks
■ Conduct Amendment to Risk Assessment	6 weeks
■ Conduct Alternatives analysis	6 weeks
■ Finalize report	3 weeks

It is estimated that the Scope of Work described in this Workplan will be completed within approximately seven months after receipt of agency approval. Extreme weather and/or unexpected field conditions may cause shifts in this schedule.

Section 4
Site Health and Safety (Minimum Requirements)

All investigative activities related to this workplan must be performed in accordance with all federal, state, and local statutes, regulations, and ordinances. These include, but are not limited to, the standards contained in *29 CFR 1910 General Industry* U.S. Department of Labor, Occupational Safety and Health Administration (OSHA). A site-specific Health and Safety Plan (HASP) and Hazard Assessment are presented in Appendix B. A list of emergency points of contact specific to all scopes of work at the LEC site is presented as Appendix C.

Workers will wear standard industrial protective gear, including the following:

- Protective eyeglasses or goggles, as required
- Ear protection, as required
- Rubber gloves, as required
- Tyvek® suits, as required
- Steel-toed boots, mandatory
- Hard hats, when working near construction equipment

Most investigative activities should not lead to the direct contact or inhalation of extracted soil, groundwater, or vapors. In general, avoid direct skin contact with groundwater, decontamination water, and soil. Flush any skin that has come into contact with groundwater, soil, or decontamination water; and remove wetted clothing as soon as practicable.

Breathing zone monitoring for VOCs will be conducted twice daily for work outside of test pits, and continually while excavating and sampling each test pit. Additional monitoring will be completed whenever the site health and safety officer believes monitoring is necessary. Monitoring will be conducted using an HNu Photoionization Detector or equivalent. The HNu instrument will be calibrated following the manufacturer's suggested procedure, and at a minimum once per day. Standard calibration gases provided by the vendor or manufacturer will be utilized. Proper care will be taken when test pits are excavated to ensure all applicable OSHA trenching regulations are followed.

Section 5
References

Following is a summary of reports and manuals referenced as supplemental documents for implementation of this workplan:

5.1 Historical Reports

- NJDEP Administrative Consent Order (ACO) dated September 26, 1986
- NJDEP Superfund Record of Decision (ROD) dated April 1994
- Workplan for Phase I ROD Implementation dated October 1994, Roy F. Weston, Inc.
- Quality Assurance Project Plan (QAPP) dated October 1994, Roy F. Weston, Inc.
- Site Health and Safety Plan (HASP) dated October 1994, Roy F. Weston, Inc.
- Remedial Action Planning Report dated November 1996, Roy F. Weston, Inc.
- NJDEP Field Sampling Procedures Manual (1992)
- Technical Requirements for Site Remediation (N.J.A.C 7:26E-2.1)
- Lead in Soils Data Compilation Report dated December, 1995, Roy F. Weston, Inc.

5.2 Site Reference and Guidance Manuals

Bayley, William S., 1910 Iron Mines and Mining in New Jersey, Geological Survey of New Jersey, MacCrellish & Quigley State Printers.

NJDEP (New Jersey Department of Environmental Protection). 1993. A Summary of Selected Soil Constituents and Contaminants at Background Locations in New Jersey, Division of Science and Research, September, 1993.

NJDEP. 1994. Superfund Record of Decision, L.E. Carpenter/Dayco Corporation Site, Wharton Borough, Morris County, New Jersey. April 1994.

NJDEP. 1998. Guide for Sediment Quality Evaluations. April 1994.

NJDOL (New Jersey Department of Labor). 1989. Abandoned Iron Mines of Minehill, Randolph Twp., & Wharton Boro, Morris County, New Jersey, Division of Workplace Standards, Office of Safety Compliance, Trenton, New Jersey.

RMT, Inc. 1999. Hot Spot B and Hot Spot C Subsurface Lead Investigation. October 1999.

RMT, Inc. 2000a. Evaluation of Remediation of Groundwater by Natural Attenuation. May 2000.

RMT, Inc. 2000b. Workplan for Delineating and Characterizing Elevated Lead Concentrations in Soil. September 2000.

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Sims, Paul K., 1958. Geology and Magnetite Deposits of Dover District, Morris County, New Jersey, Geological Survey Professional Paper 287.

USEPA. 1996. Recommendations of the Technical Review Workgroup for an Interim Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil. USEPA. December 1996.

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Weston. 1992b. Baseline Risk Assessment, L.E. Carpenter and Company, Wharton, New Jersey. January 1992.

Weston. 1994. Workplan for Phase 1 ROD Implementation, L.E. Carpenter and Company, Wharton, New Jersey. October 1994.

Weston. 1995a. Quarterly Progress Report, L.E. Carpenter Site, Wharton, New Jersey. April 1995.

Weston. 1995b. Lead in Soils Data Compilation, L.E. Carpenter Site, Wharton, New Jersey. December 1995.

Weston. 1996. Quarterly Progress Report, L.E. Carpenter Site, Wharton, New Jersey. August 1996.

W.W. Munsell & Co., 1882. History of Morris County, New Jersey, 1739-1882, with Illustrations and Biographical Sketches of Prominent Citizens and Pioneers; New York, pages 39-48 from www.rootsweb.com/~njmorris/history.htm.

Tables

Table 1
Proposed Wells for Lead Sampling and Summary of Lead in Groundwater

WELL[1] LOCATION	TOTAL WELL DEPTH (FT)	WELL DIAMETER (IN)	SCREEN MATERIAL	SLOT SIZE (IN)	TOP OF SCREEN (FT)	BOTTOM OF SCREEN (FT)	SCREENED INTERVAL (FT)	AQUIFER SYSTEM	Dissolved[2] Lead (ug/L)	Collection Date	Comments
MW-2(R)	13	2	PVC	0.01	2	12	10	S	ND		
MW-3	27	2	STEEL	0.01	1.5	27	25.5	S	ND		
MW-4	27	2	STEEL	0.01	1.5	27	25	S	3.3	Feb-95	Hydraulic gradient is from river at this location (the river is directly upgradient from this location).
MW-6(R)	10.98	2	PVC	0.02	0.98	10.98	10	S	ND		
MW-11S	14.73	4	STEEL	0.02	4.37	14.41	10	S	NA		
MW-11I(R)	52	2	STEEL	0.01	42	52	10	I	8.3(9.4)	Feb-95	Possible result of unfiltered and bailed (turbid) sample. No lead detected in this well in 1989 and 1990.
MW-14S	15.46	4	STEEL	0.02	3.42	13.46	10	S	4.4	Feb-95	Possible result of unfiltered and bailed (turbid) sample. No lead detected in this well in 1989 and 1990.
MW-14I	44.3	2	STEEL	0.02	33.22	43.26	10	I	5.3	Feb-95	Possible result of unfiltered and bailed (turbid) sample. No lead detected in this well in 1989 and 1990.
MW-15S	25.94	4	STEEL	0.02	9.37	19.41	10	S	ND		
MW-16S	23.9	4	STEEL	0.02	7.37	17.41	10	S	11.2	Feb-95	Possible result of unfiltered and bailed (turbid) sample. No lead detected in this well in 1989 and 1990.
MW-17S	15.04	4	STEEL	0.02	5.2	15.24	10	S	ND		
MW-18S	15.04	2	STEEL	0.02	4.37	14.41	10	S	11.7	Feb-95	Possible result of unfiltered and bailed (turbid) sample. No lead detected in this well in 1989 and 1990.
MW-18I	44.69	2	STEEL	0.02	34.22	44.26	10	I	4.6	Feb-95	Possible result of unfiltered and bailed (turbid) sample. No lead detected in this well in 1989 and 1990.
MW-19-3	16	4	STEEL	0.01	6	15.5	9.5	S	NA		
MW-22(R)	7.5	2	STEEL	-	-	-	-	S	ND		
MW-25(R)	10	2	STEEL	-	-	-	-	S	ND		
RW-3	28	8	STEEL	0.02	3	28	25	S	NA		
WP-A2	-	-	-	-	-	-	-	-	NA		
WP-A3	-	-	-	-	-	-	-	-	NA		
WP-A5	-	-	-	-	-	-	-	-	NA		
WP-A6	13	2	PVC	-	3	13	10	S	NA		
WP-A7	11	2	PVC	-	1	11	10	S	2.8	Jul-96	One time sampling event showing dissolved lead result. Hot-spot 4 area
WP-A8	-	-	-	-	-	-	-	-	NA		
WP-A9	16	2	PVC	-	6	16	10	S	2.2	Jul-96	One time sampling event showing dissolved lead result. Downgradient from Hot-spot B
WP-B1	11	2	PVC	-	1	11	10	S	NA		
WP-B2	11	2	PVC	-	1	11	10	S	NA		
WP-B3	11	2	PVC	-	1	11	10	S	NA		
WP-B5	11	2	PVC	-	1	11	10	S	NA		
WP-B7	-	-	-	-	-	-	-	-	NA		

LEGEND

S = Shallow Aquifer System
I = Intermediate Aquifer System
D = Deep Aquifer System
(R) = Replacement Well
(-) = well construction logs were not available for review
NA = not analyzed
ND = not detected

GENERAL NOTES

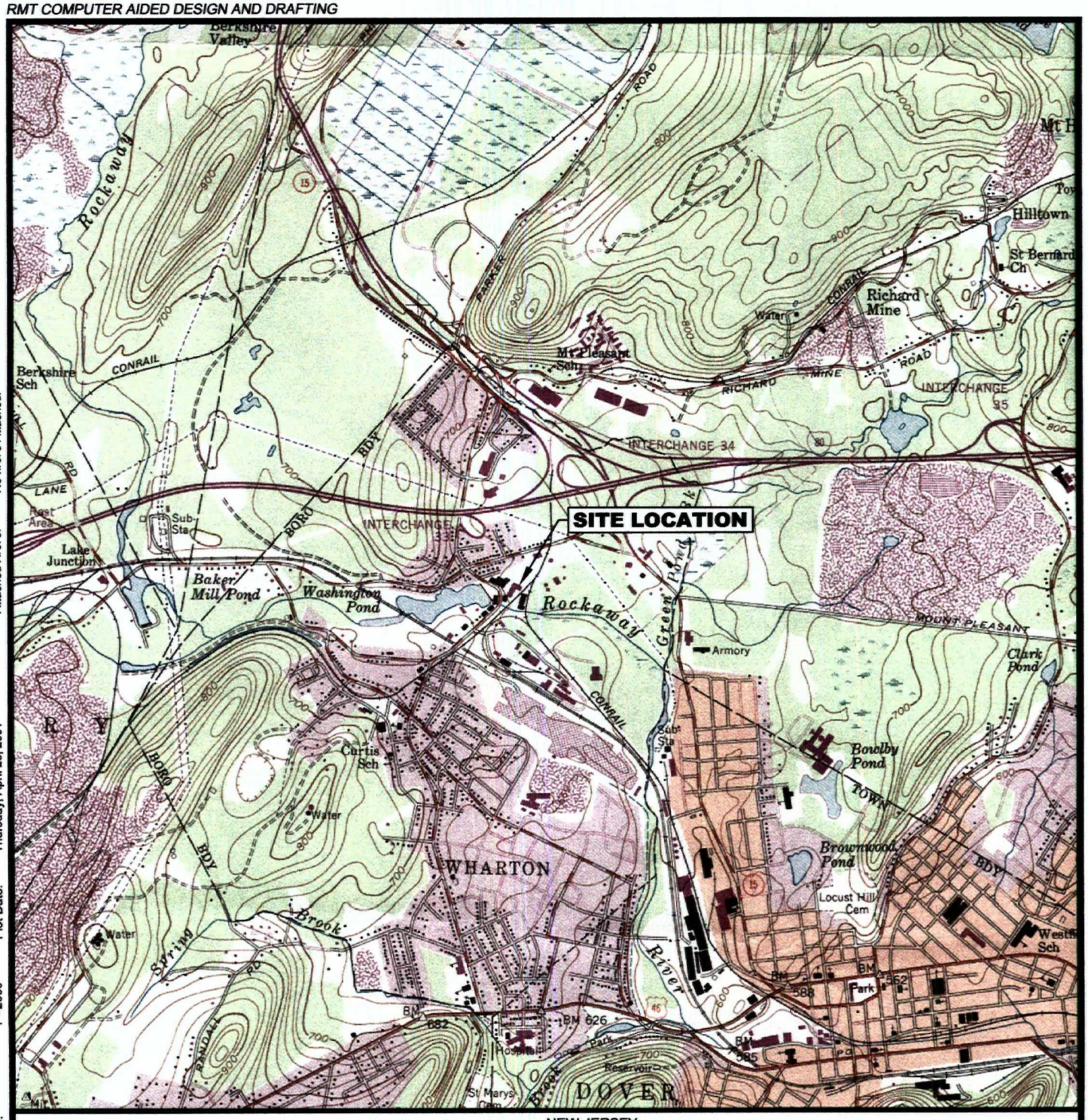
(1) All WP series wells finished elevation is 2 feet above nominal grade. Total depth of well only accounts for subsurface structure
(2) Lead results from Weston Second Quarter Progress report dated August 1996. Duplicate sample in parentheses.
The cleanup criterion for lead in groundwater is 10 ug/L as set in the ROD.

Table 2
Data Objectives for Lead Sampling and Analysis

Sample Depth Interval	Number of Samples	Type of Analysis	Figure 2 Reference Symbol	Location or method of selection	Explanation and/or Data Objective for Sample Element
0" - 6"	60	XRF	Green - Test Pits	Radial Transect (See Figure 3)	Provides a screening level of accuracy for defining horizontal extent of lead in soils on entire site
0" - 6"	20	Lab Lead	Green - Test Pits	6 low-XRF concentration and 14 high-XRF concentraton samples from above will be tested	To provide a comparison of analytical results to support conclusions on XRF screening results
Midpoint	30	XRF	Green - Test Pits	Location based on highest lead concentrations determined from screening	To delineate change in lead concentration with depth
Lowest 1'	30	XRF	Green - Test Pits	Location based on highest lead concentrations determined from screening	To delineate change in lead concentration with depth to just above water table
—	20	Lab Lead	Green - Test Pits	6 low-XRF concentration and 14 high-XRF concentraton samples from above will be tested	To provide a comparison of analytical results to support conclusions on XRF screening results
0" - 6 "	5	XRF/ Lab Lead	Off-site	Off-site	To provide a comparison of off-site and on-site lead concentrations
24" -30"	5	XRF/ Lab Lead	Off-site	Off-site	To provide a comparison of off-site and on-site lead concentrations
0' - 1'	5	XRF	Blue - Test Pits	Vicinity of Building 14	To evaluate source of elevated lead
4' - 5'	5	XRF	Blue - Test Pits	Vicinity of Building 14	To evaluate source of elevated lead
Composites	3	SPLP - Lead	Yellow Locations	Stockpile Areas	To evaluate potential for leaching of lead from stockpiled soils
Composites	3	SPLP - Lead	—	From areas tested >600 ppm lead	To evaluate potential leaching of lead from soilto the groundwater
—	10	Petrologic	Blue - Test Pits	Selected from above 10 samples	Determine provenance (geologic source) of minerals related to ore

Figures

RMT COMPUTER AIDED DESIGN AND DRAFTING



NEW JERSEY

QUADRANGLE LOCATION

N

0 2000' 4000'

APPROXIMATE SCALE IN FEET

SOURCE

1. BASE MAP DEVELOPED FROM THE DOVER, NEW JERSEY 7.5 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE MAP, DATED 1954, PHOTOREVISED 1981.

RMT INC.

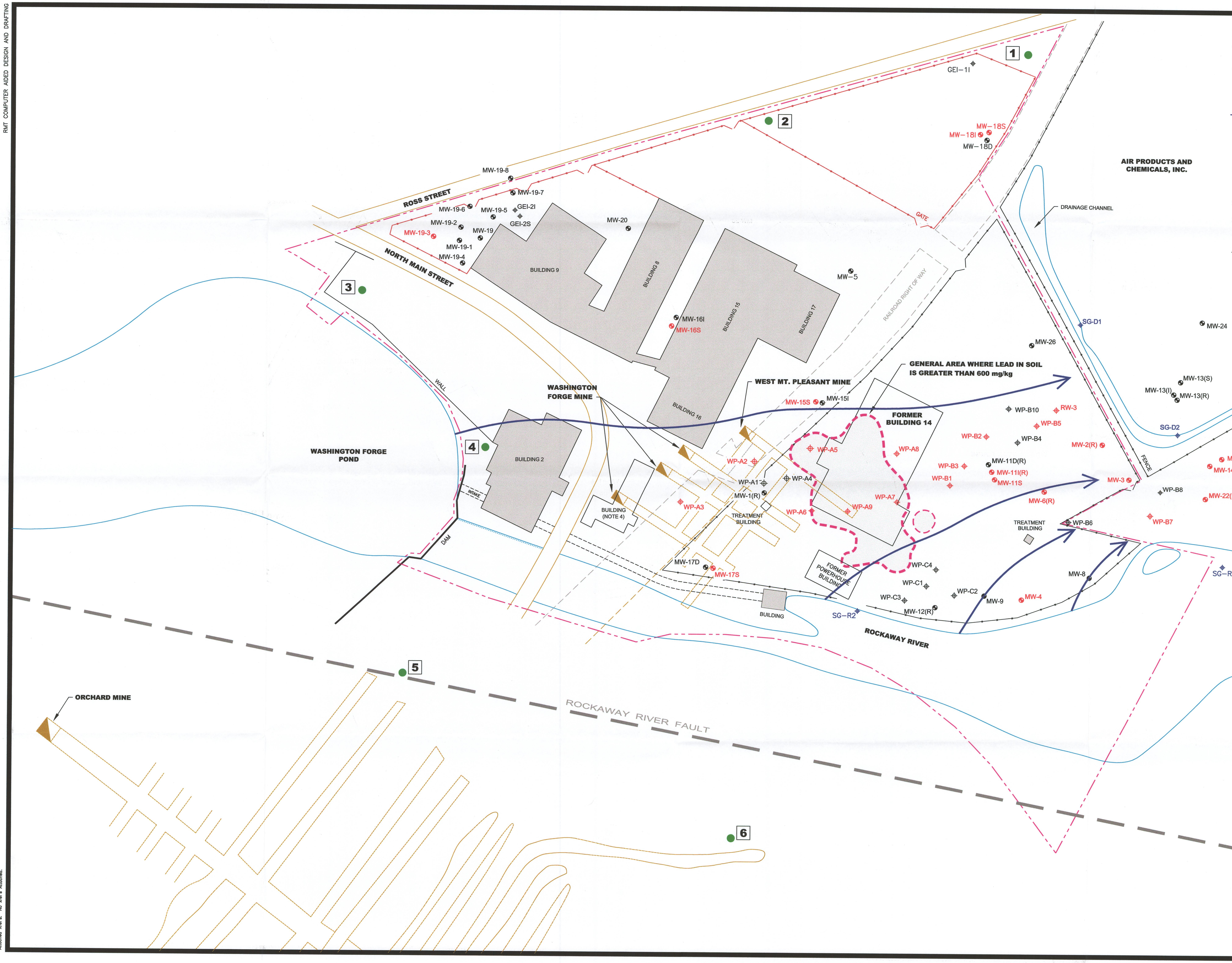
LE CARPENTER
WHARTON, NEW JERSEY

SITE LOCATION MAP

DRAWN BY:	SJL
APPROVED BY:	NC
PROJECT NUMBER:	3868.23
FILE NUMBER:	38682300.DWG
DATE:	MAY 2001

FIGURE 1

PLOT DATA
Drawing Name: J:\03868\23\38682300.dwg
Operator Name: lucidos
Scale: 1"=2000'
Dwg Size: 80344 Bytes
Plot Date: Thursday, April 26, 2001
Plot Time: 12:00.0825 PM
Attached Xref's: No xref's Attached.



LEGEND

- WATER FEATURE
- PROPERTY LINE
- FENCE
- MW-21 MONITORING WELL
- MW-21 PROPOSED MONITORING WELL TO BE TESTED FOR LEAD
- APPROXIMATE GROUNDWATER FLOW
- SG-D2 STAFF GAGE LOCATION
- 4 PROPOSED TENTATIVE BACKGROUND SAMPLING LOCATIONS

NOTES

1. MINE LOCATIONS OBTAINED FROM SIMS, 1958.
2. FORMER BUILDING 14 WAS ORIGINALLY CONSTRUCTED PRIOR TO 1927 FOR ONYX HOSIERY.
3. LEC BUILDING 2 WAS ORIGINALLY CONSTRUCTED CIRCA 1897 FOR ROSS AND BAKER MANUFACTURING. THE STRUCTURE WAS THEN USED BY GEORGE SINGLETON MANUFACTURING (CIRCA 1909), ONYX HOSIERY (CIRCA 1927), FINALLY LEC STARTED IN 1943.
4. BUILDING CONSTRUCTED IN OR BEFORE 1909 WHERE IT IS DESCRIBED AS SANBORN MAP AS E.J. ROSS, SILK MFG. IN 1916 IT IS LISTED AS VACANT; FORMERLY E.J. ROSS. IN 1927 IT IS LISTED AS ONYX HOSIERY INC. AND THE MAP SHOWS IT SPLIT INTO "OFFICE" AND "PACKING" AS DESCRIBED ABOVE. IN 1949 IT APPEARS TO BE PART OF LE CARPENTER ALTHOUGH IT IS NOT DIRECTLY LABELED AS SUCH ON THE SANBORN MAP.

0 60' 120' 180' 240'
SCALE IN FEET

NO.	BY	DATE	REVISION	APP'D.
5.				
4.				
3.				
2.				
1.				

L.E. CARPENTER
WHARTON, NEW JERSEY

PROPOSED BACKGROUND SOIL SAMPLING LOCATIONS

DRAWN BY: LUCIDOS	SCALE: SHOWN	PROJECT NO. 3868.23
CHECKED BY: JLS		FILE NO. 38682311.DWG
APPROVED BY: JDD	DATE PRINTED:	**FIGURE 1**
DATE: SEPTEMBER 2001		

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P.O. BOX 991 48106-0991
PHONE: 734-971-7080
FAX: 734-971-9022

RMT COMPUTER AIDED DESIGN AND DRAFTING

LEGEND
WATER FEATURE
PROPERTY LINE
FENCE
MW-21 MONITORING WELL
MW-21 PROPOSED MONITORING WELL TO BE TESTED FOR LEAD
APPROXIMATE GROUNDWATER FLOW
SG-D2 STAFF GAGE LOCATION
ROSS STREET
NORTH MAIN STREET
AIR PRODUCTS AND CHEMICALS, INC.
DRAINAGE CHANNEL
RAILROAD RIGHT OF WAY
GATE
FENCE
WALL
DAM
INTAKE
TRAIL RACE
WASHINGTON FORGE POND
WASHINGTON FORGE MINE
WEST MT. PLEASANT MINE
ORCHARD MINE
ROCKAWAY RIVER
ROCKAWAY RIVER FAULT
GENERAL AREA WHERE LEAD IN SOIL IS GREATER THAN 600 mg/kg
FORMER BUILDING 14
FORMER POWERHOUSE BUILDING
TREATMENT BUILDING
BUILDING (NOTE 4)
BUILDING
BUILDING 2
BUILDING 8
BUILDING 9
BUILDING 15
BUILDING 16
BUILDING 17
GEI-1I
GEI-2I
GEI-2S
MW-18S
MW-18I
MW-18D
MW-19-8
MW-19-7
MW-19-6
MW-19-5
MW-19-2
MW-19-3
MW-19
MW-19-1
MW-19-4
MW-20
MW-5
MW-16I
MW-16S
MW-15S
MW-15I
MW-26
MW-24
MW-23
MW-13(S)
MW-13(I)
MW-13(R)
SG-D1
SG-D2
SG-D3
SG-R2
SG-R3
WP-B10
RW-3
WP-B5
WP-B2
WP-B4
MW-2(R)
WP-A5
WP-A8
WP-B3
WP-B1
MW-11D(R)
MW-11I(R)
MW-11S
WP-A2
WP-A1
WP-A4
MW-1(R)
WP-A3
WP-A6
WP-A9
WP-A7
MW-6(R)
MW-3
MW-14S
MW-14I
MW-21
WP-B8
MW-22(R)
MW-25(R)
WP-B7
WP-B6
MW-17D
MW-17S
WP-C4
WP-C1
WP-C2
WP-C3
MW-12(R)
MW-9
MW-4
MW-8
N
0 60' 120' 180' 240'
SCALE IN FEET

NOTES

1. MINE LOCATIONS OBTAINED FROM SIMS, 1958.
2. FORMER BUILDING 14 WAS ORIGINALLY CONSTRUCTED PRIOR TO 1927 FOR ONYX HOSIERY.
3. LEC BUILDING 2 WAS ORIGINALLY CONSTRUCTED CIRCA 1897 FOR ROSS AND BAKER MANUFACTURING. THE STRUCTURE WAS THEN USED BY GEORGE SINGLETON MANUFACTURING (CIRCA 1909), ONYX HOSIERY (CIRCA 1927), FINALLY LEC STARTED IN 1943.
4. BUILDING CONSTRUCTED IN OR BEFORE 1909 WHERE IT IS DESCRIBED AS SANBORN MAP AS E.J. ROSS, SILK MFG. IN 1916 IT IS LISTED AS VACANT; FORMERLY E.J. ROSS. IN 1927 IT IS LISTED AS ONYX HOSIERY INC. AND THE MAP SHOWS IT SPLIT INTO "OFFICE" AND "PACKING" AS DESCRIBED ABOVE. IN 1949 IT APPEARS TO BE PART OF LE CARPENTER ALTHOUGH IT IS NOT DIRECTLY LABELED AS SUCH ON THE SANBORN MAP.

NO.	BY	DATE	REVISION	APP'D.
5.				
4.				
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2.				
1.				

L.E. CARPENTER
WHARTON, NEW JERSEY

SITE FEATURES AND PROPOSED GROUNDWATER MONITORING WELLS TO BE TESTED FOR LEAD

DRAWN BY: LUCIDOS	SCALE: SHOWN	PROJECT NO. 3868.22
CHECKED BY: JLS		FILE NO. 38682209.DWG
APPROVED BY: JDD	DATE PRINTED:	**FIGURE 2**
DATE: MAY 2001		

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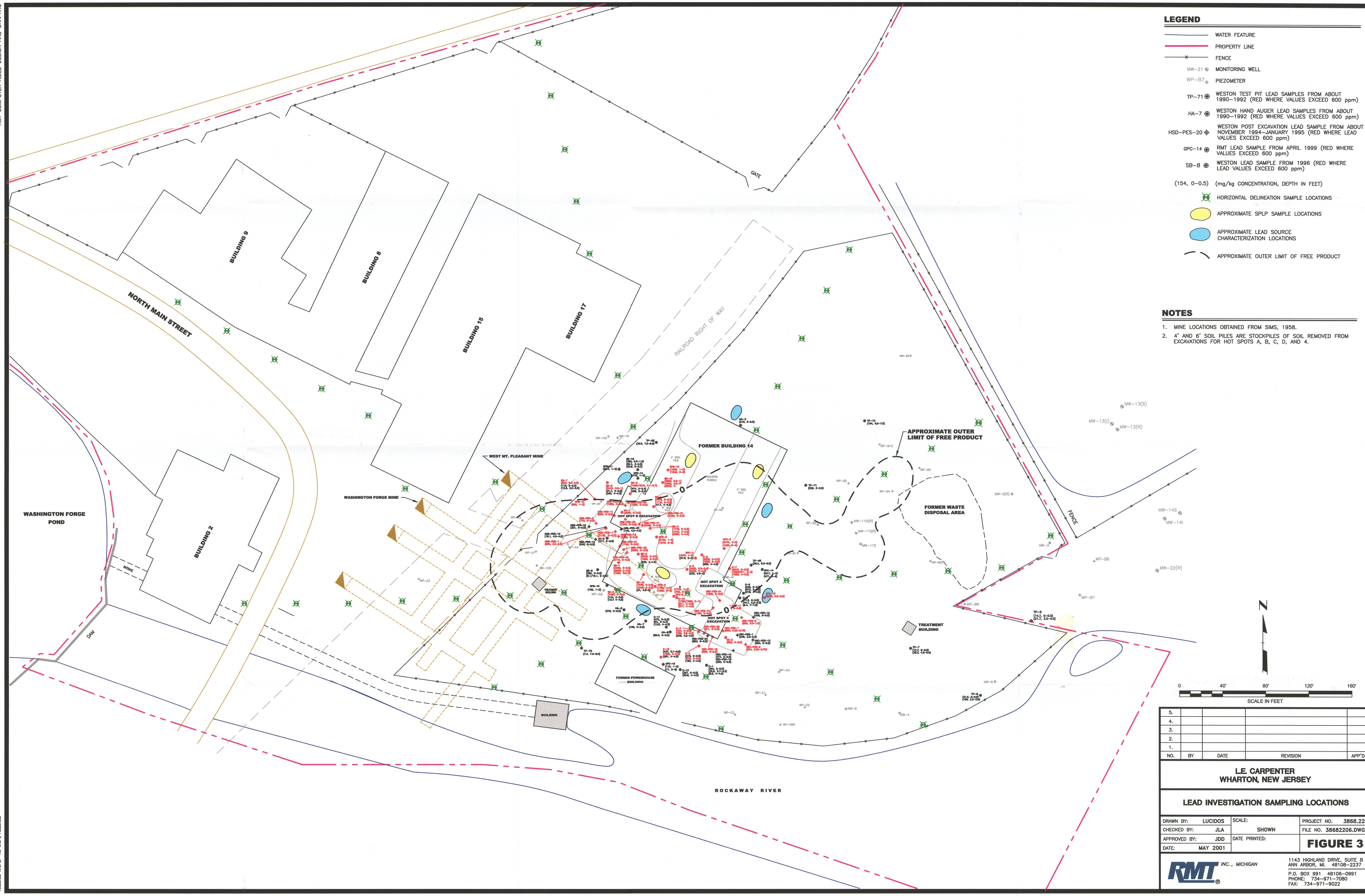

LEGEND

- WATER FEATURE
- PROPERTY LINE
- FENCE
- MW-21 MONITORING WELL
- WP-B7 PIEZOMETER
- TP-71 WESTON TEST PIT LEAD SAMPLES FROM ABOUT 1990-1992 (RED WHERE VALUES EXCEED 600 ppm)
- HA-7 WESTON HAND AUGER LEAD SAMPLES FROM ABOUT 1990-1992 (RED WHERE VALUES EXCEED 600 ppm)
- HSD-PES-20 WESTON POST EXCAVATION LEAD SAMPLE FROM ABOUT NOVEMBER 1994-JANUARY 1995 (RED WHERE LEAD VALUES EXCEED 600 ppm)
- GPC-14 RMT LEAD SAMPLE FROM APRIL 1999 (RED WHERE VALUES EXCEED 600 ppm)
- SB-8 WESTON LEAD SAMPLE FROM 1996 (RED WHERE LEAD VALUES EXCEED 600 ppm)
- (154, 0-0.5) (mg/kg CONCENTRATION, DEPTH IN FEET)
- HORIZONTAL DELINEATION SAMPLE LOCATIONS
- APPROXIMATE SPLP SAMPLE LOCATIONS
- APPROXIMATE LEAD SOURCE CHARACTERIZATION LOCATIONS
- APPROXIMATE OUTER LIMIT OF FREE PRODUCT

NOTES

1. MINE LOCATIONS OBTAINED FROM SIMS, 1958.
2. 4' AND 6' SOIL PILES ARE STOCKPILES OF SOIL REMOVED FROM EXCAVATIONS FOR HOT SPOTS A, B, C, D, AND 4.

NO.	BY	DATE	REVISION	APP'D.
5.				
4.				
3.				
2.				
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L.E. CARPENTER
WHARTON, NEW JERSEY

LEAD INVESTIGATION SAMPLING LOCATIONS

DRAWN BY: LUCIDOS	SCALE: SHOWN	PROJECT NO. 3868.22	
CHECKED BY: JLA		FILE NO. 38682206.DWG	
APPROVED BY: JDD	DATE PRINTED:	**FIGURE 3**	
DATE: MAY 2001			

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P.O. BOX 991 48106-0991
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FAX: 734-971-9022

RMT COMPUTER AIDED DESIGN AND DRAFTING

Appendix A
Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN
(QAPP)
DELINEATING AND CHARACTERIZING ELEVATED LEAD CONCENTRATIONS IN SOIL

L.E. CARPENTER AND COMPANY
WHARTON, NEW JERSEY
USEPA ID #NJ002168748

May 2001

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List of Attachments

Acronyms

AA	Atomic Absorption Spectrophotometer
AOC	Administrative Order of Consent
ASTM	American Standards for Testing Materials
BNA	Base-neutral/acid extractables (semivolatile organic compounds)
BETX	Benzene, ethylbenzene, toluene, xylene
CCB	Continuing calibration blank
CCV	Continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund), as amended by the Superfund Amendments and Reauthorization Act (SARA)
CLP	Contract Laboratory Program
COPC	Constituent of potential concern
CRA	Contract Required Atomic Absorption Spectrophotometer Standard
CRDL	Contract Required Detection Limit
CRI	Contract Required Inductively Coupled Plasma Spectrophotometer Standard
CRQL	Contract Required Quantitation Limit
CRL	Central Regional Laboratory
CVAA	Cold vapor atomic absorption spectrophotometer
DEHP	di(2-ethylhexyl)phthalate
DO	Dissolved oxygen
DQO	Data Quality Objective
FSP	Field Sampling Plan
GC	Gas chromatograph
GFAA	Graphite furnace atomic absorption spectrophotometer
ICB	Initial calibration blank
ICP	Inductively coupled plasma emission spectrophotometer
ICS	Interference check sample

ICV	Initial calibration verification
LRA	Linear range analysis
MDL	Method detection limit
MS/MSD	Matrix spike/matrix spike duplicate
NCP	National Contingency Plan
NIST	National Institute for Standards and Technology
NJDEP	New Jersey Department of Environmental Protection
OSC	On-site Coordinator
PCB	Polychlorinated biphenyl
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAS	Routine analytical services
RMT	RMT, Inc.
RPD	Relative percent difference
RPM	Remedial Project Manager
SAS	Special analytical services
SOP	Standard Operating Procedure
TOC	Total organic carbon
USEPA	United States Environmental Protection Agency
VOA	Volatile organic analysis
VOC	Volatile organic compound
XRF	X-Ray Fluorescence

Section 1
Project Description

1.1 Introduction

This Quality Assurance Project Plan (QAPP) has been prepared to accompany the *Revised Workplan for Delineating and Characterizing Elevated Lead Concentrations in Soils* dated May 2001 and prepared by RMT.

The USEPA requires that all environmental monitoring and measurement efforts mandated or supported by the USEPA be centrally managed by a QA program to ensure that the precision, accuracy, completeness, and representativeness of the RI/FS data are known and documented. This QAPP describes the protocols that will be followed for collecting and handling samples, sample storage, chain-of-custody procedures, and laboratory and field analyses.

This QAPP was prepared in general accordance with the following guidance documents:

- EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA /QA/R-5. (Draft), October 1997.
- Data Quality Objectives Process for Superfund, Interim Final Guidance, OSWER Directive 9355.9-01, September 1993.
- EPA NEIC Policies and Procedures Manual, EPA 330/978-001-R, May 1986.
- USEPA Contract laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540/R-94/013

1.2 Site Description and Background

A description and background of the site is presented in Section 1 of the Workplan.

1.3 Investigative Objectives

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results that address the data quality objectives and produce data that are legally defensible. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in this QAPP. The purpose of this QAPP is to describe the project objectives and organization, functional activities and quality assurance and quality control protocols that will be used to achieve the desired data quality objectives (DQOs) at the

L.E. Carpenter Site. The general investigative objectives of the natural attenuation investigation have been described in the Workplan.

1.3.1 Analyses

To meet the data needs, the testing program consists of the following analyses outlined in the above documents:

- Field screening for lead in soils
- Laboratory analysis for lead in soils
- Laboratory analysis for leachability of lead in soils
- pH, Eh, specific conductance, temperature, and turbidity of groundwater
- Field physical testing for groundwater level

1.3.2 Field Parameters and Uses

Sampling procedures specific to low-flow sampling are described in detail in Attachment 1. Methodologies for field screening for lead using X-Ray Fluorescence (XRF) are presented in Attachment 2. Other field instrument calibration and analytical procedures are presented within the O&M manuals provided by the manufacturer of the equipment being used.

Temperature, specific conductance, dissolved oxygen (DO), pH, Eh, and turbidity will be measured from all groundwater samples and be used as indicators of well purging stability as well as in later natural attenuation evaluations.

1.3.3 Laboratory Parameters and Uses

All laboratory analyses will be performed by Severn Trent Laboratories of Edison New Jersey (STL Edison). Data will be used to determine the extent of lead in soil and groundwater.

1.3.4 Intended Data Uses

The Workplan details the intended data uses, which are summarized briefly here. This sampling phase has been planned to provide the following information to the extent required to:

1. Quantify the horizontal and vertical extent to which lead is distributed in on-site soils
2. Determine the nature and potential anthropogenic source of elevated lead concentrations on site
3. Determine if any lead has the potential to leach into groundwaters exiting the site

1.4 Sample Network Design and Rationale

The soil sample locations and rationale for selected sample locations are described in Table 1 of Section 3 of the Workplan. Figure 2 of the Workplan presents the groundwater sampling locations. The sample analytical parameters are indicated in Table 1 below.

Table 1
Field and Laboratory Analyte List

FIELD METHODOLOGIES		ANALYTES
Groundwater	Purge Stability using a micro purge cell, probe and electrodes	DO, Eh, pH, specific conductance, temperature, turbidity
Soils	XRF Screening	Lead
LABORATORY METHODOLOGIES		**ANALYTES**
Groundwater	Soluble Metals	Lead
	Total Metals	Lead
Soils	Total Metals	Lead
	Leachable Metals	Lead

1.5 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support decisions made during evaluation activities and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. There are two analytical levels which address various data uses and the QA/QC effort and methods required to achieve the desired level of quality. For this investigative evaluation these are as follows:

1.5.1 Screening Data

These data are generated by less precise analytical methods with less rigorous sample preparation than those with definitive level methods. Sample preparation steps may be restricted to simple procedures, such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data provide analyte identification and quantification, although the quantification may be relatively imprecise. A portion of screening data may be confirmed using analytical methods and QA/QC procedures and criteria associated with definitive data. Screening data without associated confirmation data are not considered to be data of known quality.

Groundwater: Screening quality data will be used for field-measured parameters such as pH, Eh, temperature, specific conductance, dissolved oxygen, turbidity, and depth to groundwater. These data will be used to determine if sufficient purging of monitoring wells has been performed.

Soils: XRF methodologies will be used to screen soils for distribution of lead. The data will be used to select samples for laboratory analysis for lead and to locate test pits for vertical soil sampling for lead. Data from the XRF will be coupled with mineralogic and petrologic observations obtained by analysis with binocular and petrographic microscopes. These data will be used in an effort to determine whether lead concentrations are associated with ore deposits, native soils, or process wastes from past LEC operations.

1.5.2 Definitive Data

These data are generated using rigorous analytical methods, such as approved USEPA methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data (*e.g.*, chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files. Data may be generated at the site or at an off-site location as long as QA/QC requirements are satisfied. For the data to be definitive, either analytical or total measurement error or precision of the analytical method must be determined.

The following data will be collected to meet definitive data quality objectives:

- Groundwater will be analyzed for total and soluble lead in accordance with USEPA-SW 846 analytical protocols Method 6010B and data validation procedures. These data will be used to determine the potential for leaching of on-site soils into groundwater beneath the site.
- Selected soil samples will be analyzed for lead using EPA Method 6010B. These data will be used to confirm the presence and level of lead determined from the filed screening, and along with the field screening data, will be used to delineate the horizontal and vertical extent of lead on site.
- Additional selected soil samples will be analyzed leachability by EPA Method 6010B. These data will be used to further assess any human health or ecological risk presented by lead on or migrating from the site.

Section 2
Project Organization and Responsibilities

2.1 Identification of Key Project Personnel

The monitoring well and groundwater sampling will be performed by RMT, Inc, on behalf of the L.E. Carpenter Corporation. The key management and technical staff responsible for the execution of the Remedial Design:

- James J. Dexter, CPG, Project Director and **Project Coordinator**
- Nicholas J. Clevett, **Project Manager**
- Andrew F, Diefendorf, CPG, Senior Consultant **and Technical Coordinator**
- Kirsti Sorsa, Ph.D., **QA/QC Officer** and Data Validation Coordinator

Personnel involved in the investigation, and in the generation of data as a result of investigation activities, become a part of the overall Project Quality Assurance program. Within that program, the following individuals have specific responsibilities: the Project Coordinator, the Technical Coordinator and the field personnel. Specific laboratory personnel with Quality Assurance/Quality Control responsibilities include the Laboratory Quality Assurance Officer and the Laboratory Scientists and Technicians.

2.2 USEPA Region II and NJDEP Remedial Project Managers (RPMs)

The USEPA Region II Project Manager and NJDEP Project Manager are Mr. Stephen Cipot and Mrs. Gwen Zervas respectively. These two individuals are the primary project points of contact for their respective agencies and have the responsibility for coordinating regulatory status and issues within/between the USEPA Region II and the NJDEP, and ensuring that all natural attenuation activities comply with applicable standards and technical guidance.

2.3 RMT Project Coordinator

James Dexter will provide senior project management oversight, technical direction, and review RMT's performance on this project. He will also provide input concerning Superfund procedures and conformance with the National Contingency Plan (NCP).

2.4 RMT Project Manager

Nicholas Clevett will provide overall management of all project initiatives, and will establish and communicate schedules and budgets to both technical staff and the technical coordinator.

He will aid the project coordinator with all USEPA and NJDEP initiatives, and will also assist both the project and technical coordinators with overall technical direction. He will also coordinate activities with the USEPA and the NJDEP as appropriate.

2.5 RMT Technical Coordinator

Andrew Diefendorf will be responsible for implementation of the Workplan and will provide overall senior QA/QC. He will coordinate technical staff assignments both in-house and in the field, and as necessary, will contact the USEPA RPM regarding status, technical or regulatory issues.

2.6 RMT Field Coordinator

The Field Coordinator will be the principal field team member primarily responsible for project field coordination and in-field Quality Assurance activities. The Field Coordinator will guide the field personnel in achieving a thorough understanding of the project Quality Assurance Plan and their respective roles relative to one another within the established project framework. The Field Coordinator will also act as the site Health and Safety Representative (HSR).

The Field Coordinator is also responsible for the day-to-day activities of contractor field personnel. In this capacity, the Field Coordinator is responsible for the Quality Assurance of daily project activities and the maintenance of the Quality Assurance Project Plan. Further responsibilities include the review of field notebooks, driller's logs, and other field-related documentation.

2.7 RMT Field Personnel

These environmental staff will be responsible for measuring and recording field parameters; installing monitoring points, collecting, labeling, and transporting samples; and conducting in-field measurements, in accordance with the Workplan and QAPP. They will report to the Field Coordinator.

2.8 RMT Laboratory Coordinator

The Laboratory QA/QC Coordinator will be responsible for ensuring that applicable QA/QC procedures are followed. This will include reviewing QA/QC procedures and documentation, and directing the data validation and assessment activities, also be responsible for internal performance and system audits.

Section 3
Quality Assurance Objectives for Measurement Data

Data quality requirements are based on the intended use of the data, the measurement process, and the availability of resources. Data quality requirements include detection limits, accuracy, and precision Quality Assurance protocols for the analytical methods to be used and the analyses to be conducted. Specific guidelines for accuracy, precision, completeness, and representativeness are discussed in the following subsections. Field blank, trip blank, decontamination evaluation (*i.e.*, "rinsate" or "equipment") blanks, and field duplicates described in Section 11 of this QAPP will be subjected to the same Quality Assurance objectives as samples.

3.1 Accuracy

Accuracy is defined as the degree of agreement of a measurement or average of measurements with an accepted reference or true value. Accuracy control limits for the analyses are included in the laboratory SOPs.

The project-specific QA objectives established for accuracy are expressed in the following parameters.

3.1.1 Recovery of Analyte Spikes

Accuracy of laboratory results will be assessed for compliance with the established QC criteria using the analytical results of method blanks, reagent/preparation blanks, matrix spike/matrix spike duplicate samples, field blanks, and trip blanks.

To ensure the accuracy of the analytical procedures, an environmental sample will be randomly selected and spiked with a known amount of the analyte or analytes to be evaluated. In general, a sample spike is included in every set of 20 samples tested on each instrument. The spike sample will then be analyzed. An increase in the analyte concentration due to the spike addition, compared to the concentration in the unspiked sample, determines the percent recovery. The percent recovery (%R) of matrix spike samples will be calculated as follows:

$$Spike\ Recovery\ (\%) = \left(\frac{ug\ X\ found\ in\ spiked\ sample - ug\ X\ in\ native\ sample}{ug\ X\ added\ to\ sample} \right) x\ 100\%$$

Spike recovery data is used to check for possible sample matrix interference and analytical bias. The objectives for the spike recovery from aqueous matrices are given in the USEPA-approved methods and laboratory SOPs.

3.1.2 Reference Materials

Reference materials used as calibration standards or surrogate compounds will be certified, commercially available materials.

3.1.3 Instrument Performance

Instruments used in this project will be checked each day that samples are analyzed to demonstrate instrument performance. The QA objectives for instrument sensitivity, calibration, and performance are established in the USEPA-approved analytical methods and laboratory SOPs. These methods are listed in Section 8 of this QAPP.

3.1.4 Recovery of Surrogates

Surrogate compound recovery is utilized to evaluate proper performance of the analytical method and/or possible matrix interference to the analytical method for organic compounds.

The recovery of a surrogate compound (S) added to a sample will be defined as follows:

$$Recovery\ \% = \frac{ug\ S\ found\ in\ sample}{ug\ S\ added\ to\ sample} x\ 100\%$$

This equation assumes that the surrogate is not present in the sample. The objectives for recovery of surrogates from aqueous matrices are given in the USEPA-approved methods and laboratory SOPs.

3.2 Precision

Precision is defined as a measure of mutual agreement among individual measurements of a sample property. Comparing analytical results laboratory duplicate analyses for inorganic analysis will assess precision of laboratory analyses. The project QA objectives established for precision are expressed in the following parameters.

3.2.1 Analysis of Standards

One of the QA objectives for this project is that each initial calibration curve and subsequent (*i.e.*, "continuing") calibration standards meet or exceed the minimum QA criteria established in the USEPA-approved methods and laboratory SOPs.

3.2.2 Analysis of Spiked Samples

A second QA objective for this project is that the results of spiked samples (*i.e.*, matrix spikes) and spiked sample duplicates (*i.e.*, matrix spike duplicates) be within the advisable recovery and Relative Percent Difference (RPD) limits specified in the USEPA-approved methods and laboratory SOPs.

3.2.3 Analysis of Duplicate Samples

A third QA objective for this project is that analyte concentrations be comparable between duplicate samples. This includes 1) duplicate samples collected in the field, 2) duplicate analyses resulting from matrix spike and matrix spike duplicate samples, and 3) results generated from multiple analyses of a sample performed at the laboratory.

A measure of precision is Relative Percent Difference (RPD) of two analyses of the same sample. This measure is applied as a quality control criterion to the recovery of organic matrix spike compounds. Splitting of the sample allows the determination of the precision of the preparation and analytical techniques associated with the duplicate sample. The relative percent difference (RPD) will be calculated using the equation:

$$\%\,RPD = \frac{S - D}{(S + D)/2}\, x\, 100\%$$

RPD criteria for organic matrix spike compounds are given in the USEPA-approved methods and laboratory SOPs.

3.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected under normal conditions. It is expected that 95 percent or more of all samples tested via USEPA and SOP methods will provide data meeting QC acceptance criteria. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\%\,Completeness = \frac{Number\ of\ valid\ results}{Number\ of\ possible\ results}\, x\, 100\%$$

3.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that is dependent on the proper design of the sampling program and the proper laboratory protocol. The sampling program described in the FSP was designed to provide data that is representative of site conditions. Sampling sites, sampling frequency, sampling procedures, and sampling equipment are addressed in the FSP to obtain representative samples. Other procedures such as sample preservation, appropriate sample containers, sample hold times, and analytical procedures are addressed in this QAPP.

3.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in this QAPP, are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of differences in procedures and QA objectives.

Data acquired for different purposes using different analytical methods, or different DQOs, may not be directly comparable. Samples analyzed using approved methods are expected to be comparable.

Section 4
Sampling Procedures

Specific field procedures for purging wells and actual sample collection procedures are addressed in the attached SOPs for low-flow sampling. Details on soil sampling procedures and location are given in the Workplan. The collection of QC blanks, duplicate samples, and spike samples will be discussed in Section 11 of this QAPP.

Sample container, preservation procedures and holding time requirements are presented in Table 2. Pre-cleaned sample containers will be obtained from analytical laboratories or sample bottle suppliers such as I-Chem Research, Inc., New Castle, Delaware, and Daniel Scientific, Simpsonville, South Carolina. The preparation of sample bottles (*e.g.*, preservative added) will be documented.

Table 2
Sample Containers, Preservatives, and Holding Times

PARAMETER	CONTAINER(S)[2]	MINIMUM SAMPLE VOLUME	FIELD PRESERVATION METHOD	HOLDING TIME[1]
Soluble Lead in Groundwater	500 mL high-density polyethylene bottle	500 mL	Field Filter, add HNO_3 to pH < 2	6 months
Total Lead in Groundwater	500 mL high-density polyethylene bottle	500 mL	add HNO_3 to pH < 2	6 months
Total Lead in Soils	4 ounce wide-mouth glass jar	100 g	None	6 months
Leachable Lead in Soils	6 ounce wide-mouth glass jar	150 g	None	6 months
Total Organic Carbon	4 ounce wide-mouth glass jar	30 g	Cool to 4°C	28 days

(1) Starting from time of sample collection.
(2) Collect extra container for sample spike and duplicate analyses.

Section 5
Sample Custody

Chain-of-custody documentation enables possession of a sample to be traced from sample collection through analysis and disposal. A sample is considered under custody if:

- the item is in a person's possession;
- the item is in that person's view after being in his or her possession;
- the item was in that person's possession and then placed in a secured location; or
- the item is in a designated and identified secure area.

The field technician performing sample collection activities will be responsible for sample custody in the field. The laboratory sample custodian and analysts will be responsible for custody of the sample at the laboratory.

5.1 Field Chain-of-Custody

Prior to collecting samples in the field, the Field Personnel will obtain the sample bottles necessary for the field operation. Field Personnel will label each sample collected, filling in the appropriate information in waterproof ink. The field sampler will be responsible for collecting the samples and for logging the samples into assigned field notebooks. The field samplers will complete and verify the Chain-of-Custody forms. A sample form can be found in Attachment 3. A copy of the Chain-of-Custody will be placed in the project files and the original will accompany the samples to the laboratory. The identity of field duplicate samples will not be disclosed to the analytical laboratory. Sample analysis request forms will be prepared by the RMT Laboratory Coordinator, or prepared by Field Personnel and reviewed by the RMT Laboratory Coordinator. The analytical request forms will accompany samples, or precede delivery of samples, to the laboratory.

5.2 Transfer of Custody and Sample Shipment

Shipping containers will be sealed and accompanied by the Chain-of-Custody record, with appropriate signatures. The transfer of custody is the responsibility of the Field Personnel and the laboratory staff. The procedures to be implemented are as follows:

- Place completed chain-of-custody forms in a plastic bag, seal the bag, and tape it to the inside cover of the shipping container. After the samples are iced, seal the coolers with strapping tape and custody seals, add the date to the custody form, and ship the coolers to STL using an overnight delivery service. Identify common carriers or intermediate individuals on the chain-of-custody form, and retain copies of all bills-of-lading. When the samples are received in the laboratory, handle and process them in accordance with the procedures in laboratory SOPs, or specified analytical methods.

5.3 Laboratory Custody Procedures

In the laboratory, a sample custodian will be assigned to receive the samples. Upon receipt of a sample, the custodian will inspect the condition of the samples, reconcile the sample(s) received against the Chain-of-Custody record, log in the sample(s) in the laboratory log book, and store the sample(s) in a secured sample storage room or cabinet maintained at an appropriate temperature until assigned to an analyst for analysis. Custody will be maintained until the sample is discarded.

The sample custodian will inspect the sample for any leakage from the container. A leaky multi-phase sample will not be accepted for analysis as this sample would no longer be a representative sample.

The custodian will examine whether the sample bottle seal is intact or broken, since a broken seal may mean sample tampering and may make analytical results inadmissible in court as evidence. The RMT Laboratory QA/QC Coordinator will be promptly notified of broken seals so that appropriate action may be taken (*e.g.*, collect another sample).

When samples requiring preservation by either acid (except samples for volatile organic compound analysis) or base are received at the laboratory, the pH will be measured and documented. The Laboratory sample custodian will adjust the pH, if necessary, and the RMT Laboratory QA/QC Coordinator will be promptly notified of the pH adjustment so that sample collection procedures can be reviewed to determine if a modification is necessary.

Discrepancies observed between the samples received, the information that is on the Chain-of-Custody record, and the sample analysis request sheet will be resolved before the sample is assigned for analysis. The RMT Laboratory QA/QC Coordinator will be informed of any such discrepancy as well as its resolution. Results of the inspection will be documented in the laboratory sample logbook. Discrepancies will be documented in the analytical case narrative, as appropriate.

5.4 Sample Labels and Seals

Sample labels as shown in Attachment 4 will be affixed to each sample bottle before sample collection. At a minimum, the sample label will contain the following:

- Client - Job Name/Project Number,
- Sample Identification,
- Date and Time Collected (except for duplicate samples),
- Sampler's Signature (or initials), and
- Preservatives Added.

Section 6
Sampling Site Location and Sampling Activity Identification

Details on field documentation procedures are outlined in the Workplan and generally in the text below.

6.1 Field Logbooks

Information pertinent to the soil and groundwater investigation will be recorded in field logbooks. Field logbooks will be bound, with consecutively numbered pages. The pages will be dated and signed by the person who is recording the information. Unused space at the bottom of a page will be crossed through. Work sketches or phrases that are recorded but deemed incorrect will be marked through in such a way as to still be legible, yet obviously struck from the text. Mark-throughs will be initialed and dated by the person striking the item.

Persons leading a sampling team or performing a distinct task will be issued a field logbook by the RMT Field Coordinator. That person will maintain the logbook throughout the investigation. At the conclusion of the various phases of the investigation, the field books will be collected and reviewed by the Field Coordinator.

6.2 Photographs

Sampling site locations will be identified on a site map. The location will be cross-referenced in the field notebook as to the identification of samples collected from the site location. Photographs of the sampling site location and the activities occurring at a specific location will be made. Photographs will be cross-referenced with an identification/explanation narrative in the field notebook.

Section 7
Calibration Procedures

7.1 Laboratory Calibration

The calibration procedures to be used for this project are summarized below, and will follow the analytical methods specified in Section 8 of this QAPP.

7.1.1 Instrument Performance and Tune

Prior to analysis of each set of samples and on a daily basis during the analysis, it will be demonstrated that the instruments meet the operating performance standards established in the applicable analytical methods. If an instrument does not meet the performance standards it will be tuned, repaired, or replaced until the performance criteria are achieved.

7.1.2 Calibration Curve

For analyses of analytes listed in Section 8 of this QAPP, instruments will be calibrated or standardized, as appropriate for the analytical method being used, prior to the analysis of each batch of samples. Instrument calibration will be verified on the frequency as prescribed in the applicable protocols (*e.g.*, every 12 hours for volatile and semivolatile organic compounds). A new calibration curve will be established if the response observed in the analysis of the continuing calibration check standard varies outside of prescribed protocol limits. The details to the calibration procedures are described in the analytical methods and laboratory SOPs.

7.2 Field Calibration of Groundwater Instruments

In addition to the laboratory analyses conducted during the course of this investigation, field measurements of pH, specific conductance, temperature, dissolved oxygen, Eh, and turbidity will be taken for groundwater samples. The following is a brief discussion on field instrument calibration.

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Equipment to be used during the field sampling will be examined to confirm that it is in good operating condition. This includes checking the manufacturer's operating manual and the

instructions for each instrument to ensure that maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so notations on prior equipment problems are not overlooked, and those necessary repairs to equipment have been completed. A spare pH electrode and a thermometer will be sent to sampling locations where pH and temperature measurements are required, including those locations where a specific conductivity probe/thermometer is required.

Field instruments will include a water level indicator and a multi-function flow through cell and meter such as the YSI 6y280 that has multiple sondes for specific conductivity, DO, pH, Eh, Temperature and turbidity. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be removed from service.

The equipment will be checked for any mechanical or electrical failures, weak batteries, and cracked or fouled electrodes before mobilizing for field activities. Calibrations and repairs will be recorded in a bound notebook with the date and the name of the person making repairs/calibrations. The equipment will be calibrated before use and at least once for every half day of use. In the event that a multiple sonde meter is not available, single sonde meters such as those listed below will be used for field measurements.

7.2.1 pH

The pH measurements will be made using a Geotech Model P3 flow-through cell (or equivalent). During use, the pH probe will be calibrated utilizing pH 4 and pH 7 buffer solutions. The pH of each sample will be measured in the flow-through cell. The pH measurements will be recorded to the nearest 0.1 pH unit.

7.2.2 Specific Conductance

The specific conductance probe will be calibrated to a stock calibration solution. The calibration must be within 10 percent of the calibration value of the solution. Specific conductance measurements will be made in the flow-through cell, and are automatically corrected by the instrument to 25°C. Measurements will be reported in μmhos/cm.

7.2.3 Temperature

Temperature will be measured to the nearest 0.2°C within the flow-through cell. Temperature measurements are utilized directly by the instrument to correct the specific conductance reading.

7.2.4 Turbidity

To assess monitoring well development and the representative nature of groundwater samples, the groundwater will be field-analyzed for turbidity using an in-field nephelometer (Hach Model 2100P, or equivalent). The meter will be calibrated before use according to procedures outlined in the operations manual.

7.2.5 Dissolved Oxygen

The DO measurements will be made using a YSI Model 95 or Geotech Model P3 Dissolved Oxygen Meter (or equivalent). Calibration consists of exposing the probe to a known oxygen concentration such as air at 100 percent relative humidity or water of a known oxygen content, and then adjusting the O_2 CALIB control so the display shows a reading that matches the O_2 concentration of the known sample. The instrument is automatically temperature compensated to an accuracy of ± 1 percent of the dissolved oxygen reading between 5°C and 45°C; and to an accuracy of ± 1.5- 2 percent between 0°C and 5°C.

7.3 Soil Screening Instruments

XRF screening will be conducted using a NITON Xl-309 or 700 Series XRF meter. Details on the use and calibration of this equipment is presented in Attachment 2.

Section 8
Analytical Procedures

8.1 Laboratory Analysis

The laboratory will follow analytical procedures as listed below:

- Total lead in soil – EPA Method 6010B
- Total lead in groundwater – EPA Method 6010B
- Soluble lead in groundwater – EPA Method 6010B
- Total lead in soil – EPA Method 6010B
- Extractable lead in soil by "Synthetic Precipitation Leaching Procedure" – EPA Method 1312

8.2 Field Analyses

To ensure that the analytical data gathered in the field are both valid and unbiased, the following steps will be taken:

- Field samplers will be trained in the use of each piece of equipment.
- Operating manuals will accompany each piece of equipment in the field.
- Preventive maintenance programs will be carried out on a scheduled basis.
- Spare components will be taken into the field in case of equipment failure or damage.
- Instruments will be calibrated on a daily basis and rechecked as specified in the SOPs.
- Readings and calibrations will be documented.

The accuracy, sensitivity, and precision of the field analytical techniques for measuring water levels, temperature, specific conductivity, turbidity, DO, redox potential (Eh), and pH are dependent upon the specifications for the instruments used, as well as on the QC techniques employed during their use. Field analytical procedures to be used for this project are described in the attached SOPs and manufacturers O&M Manuals.

Section 9
Data Reporting, Validation, and Reduction

9.1 Field Data

Data validation practices will be followed to assure that raw data are not altered and that an audit trail is developed for data that require reduction. Field data, such as those generated during field measurements, will be entered directly into a bound field notebook. Only direct-reading instrumentation will be employed in the field. With the exception of the temperature correction for specific conductance, no calculation will be involved in field data reduction. Procedures to evaluate field data will primarily include checking for transcription errors and reviewing field notebooks, by field staff. This task is the responsibility of the Field Coordinator. The Field Coordinator will review field measurements recorded in the field books and field chain-of-custody forms to determine that procedures specified in the FSP have been followed. Project team members will be responsible for proofing data transfers.

9.2 Laboratory Data

STL, Edison, New Jersey will perform in-house analytical data reduction under the direction of the Laboratory QA Manager. The Laboratory QA Manager will be responsible for assessing data quality and advising of any data that were rated "preliminary" or "unacceptable" or of other notations that would caution the data user of possible unreliability. Data reduction procedures for the analytical methods are included in the associated laboratory SOPs.

The analytical laboratories will prepare and retain full analytical and QC documentation. Such retained documentation need not be hard (paper) copy, but may be in other storage media (*e.g.*, computer diskette or magnetic tape). As needed, the laboratory will supply a hard copy of the retained information. The electronic data deliverable will be in the format specified by RMT so that the data can be readily incorporated into a relational database. The laboratory will provide the following information in each analytical data package submitted:

1. Cover sheet listing the samples included in the report and narrative comments describing problems encountered in analysis.
2. Tabulated analytical results.
3. Summaries of applicable QC sample analysis (spikes, duplicates, laboratory control samples and blanks).

Analytical Data Reports will be available from the laboratory within four weeks following the receipt of the samples.

Upon receipt of the laboratory data reports, the RMT Laboratory QA/QC Coordinator or designated data reviewer will validate the data. Data validation consists of a review of the data for compliance with the established QC criteria based on the spike, duplicate, and blank results provided by the laboratory. Data validation will determine whether the procedures specified in the QAPP were implemented, the DQOs specified in this QAPP were attained, the specified reporting limits were achieved, and the sample holding times were met. The GC/MS instrument performance check sample results will be evaluated. An evaluation of data accuracy, precision, sensitivity, and completeness, based on method-specific criteria, will be performed according to the following guidance documents:

- National Functional Guidelines for Inorganic Data Review. USEPA, February 1994.

Method specifications provided in the laboratory SOPs will be used as guidance for validating data for non-CLP analytes listed in this QAPP.

- The data validation report will address the following items:
  - Overall quality and usability of the data
  - Evaluation of QC data, including precision, accuracy, and completeness of the data
  - Potential sample contamination due to blank contributions
  - Assessment of laboratory and field records
  - Actions regarding specific QC criteria exceedences.

RMT anticipates that data reporting for this phase of the investigation will consist of tabulating analytical results from Analytical Data Reports into summary tables through the use of computerized relational database and spreadsheet software. Reduced data will be placed in the central file maintained by the RMT Technical Coordinator.

9.3 Data Archival

The records management program will track investigation documentation so that it is available when the remedial design has been completed. Accountable documentation include items such as logbooks, field data records, correspondence, Chain-of-Custody records, analytical reports, photographs, computer disks, and final reports. The RMT Technical Coordinator is responsible for maintaining a file in which all accountable documents will be inventoried. Raw data generated during field operations will be filed to eliminate or correct errors arising from the transfer of data. In order to avoid errors in the transfer of data, copies of raw data from the field notebooks and the data as received from the laboratory will be entered into a data file. The data file will serve as the ultimate archive for information and data generated during this investigation.

Section 10
Internal Quality Control Checks

Quality Control procedures for field analyses such as pH, specific conductivity, dissolved oxygen, redox potential (Eh), turbidity, and temperature measurements consist of proper instrument calibration.

Internal Quality Control Checks used to assess field sampling precision and bias include the collection of the following blanks and samples:

- **Field/Atmospheric Blanks** – These blanks consist of organic free, deionized water contained in each sample container with any preservatives required for that analysis. These will serve as a QC check on the field sampling methods for the analytes, container cleanliness, and external contamination. A field blank will be submitted for each sampling event.

- **Field Duplicate Samples** – Duplicate samples will be collected to allow determination of analytical repeatability and sample homogeneity. At a minimum, one duplicate sample for every twenty ground and/or surface water samples, and one duplicate for every twenty soil and/or sediment samples, will be collected and submitted for analysis. Duplicate samples will be labeled in a manner such that their sampling point location is not disclosed to the laboratory. The duplicate sample number (*e.g.* DU-1) and its corresponding sample location will be recorded in the field notebook. Sampling date and time will ***not*** be filled out on the label of the duplicate sample nor on the Chain-of-Custody form in order to not to disclose the duplicate's sample point location.

- **Duplicate Samples** – The laboratory will analyze sample spike/sample duplicate (inorganic analytes) sample pairs for as QC checks for accuracy and precision. The spike concentrations added into QC samples will be consistent with the analytical methods and laboratory SOPs.

Section 11
Performance and System Audits

11.1 Field Performance Audits

11.1.1 Internal Field Audits

On-site audits may be performed to review field-related Quality Assurance activities. The Field Coordinator, the Technical Coordinator, or a senior technical scientist may conduct internal audits.

Specific elements of the on-site audit may include, but are not limited to, verification of the following items:

- Completeness and accuracy of sample Chain-of-Custody forms, including documentation of times, dates, transaction descriptions and signatures;
- Completeness and accuracy of sample identification labels, including notation of time, date, location, type of sample, person(s) collecting sample, preservation method used, and type of testing required;
- Completeness and accuracy of field notebooks, including documentation of times, dates, drillers' names, sampling method used, sampling locations, number of samples taken, name of person(s) collecting samples, types of samples, results of field measurements, soil logs and problems encountered during sampling;
- Adherence to health and safety guidelines including wearing of proper protective clothing. Level D protective clothing will be worn at a minimum and will be upgraded, if necessary, as specified in the Health and Safety Plan;
- Adherence to decontamination procedures as outlined in the site Health and Safety Plan, including proper washing or steam cleaning of pumps and pump tubing, bailers, and soil sampling equipment;
- Proper calibration and maintenance of field instruments;
- Adherence to sample collection, preparation, preservation, and storage procedures as outlined in the Workplan.

11.1.2 External Field Audits

The USEPA Region II and/or the NJDEP may conduct external field audits.

11.2 Laboratory Performance and System Audits

11.2.1 Internal Laboratory Audits

Laboratory audits consist of random data reviews, continuous trend analysis of laboratory QA data, and periodic analysis of performance evaluation samples. Systems audits are performed to verify the continuity of personnel, instrumentation, and quality control requirements contained in the SOPs. Each analytical laboratory is responsible for its own audits.

11.2.2 External Laboratory Audits

USEPA Region II and/or the NJDEP may conduct external laboratory system audits.

Section 12
Preventative Maintenance

The maintenance procedures discussed in the following subsections will be performed to maximize efficiency and minimize downtime in the laboratory and while working on the L.E. Carpenter Site.

12.1 Laboratory Maintenance

As part of their QA/QC program, the analytical laboratory to minimize the occurrence of instrument failure and other system malfunctions conducts a routine preventive maintenance program. Each team in the laboratory performs routine scheduled maintenance and repair or coordinate with the vendor for the repair of all instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications or as appropriate for the instrument. The preventive maintenance procedures for the test instruments will follow established by the laboratory's SOPs. All maintenance activities will be documented in the record books to provide a history of maintenance records.

12.2 Field Maintenance

Routine daily maintenance procedures conducted in the field will include the following:

- Removal of surface dirt and debris from exposed surfaces of the sampling equipment measurement systems.
- Storage of equipment away from the elements.
- Daily inspections of sampling equipment and measurement systems for possible problems (*e.g.*, cracked or clogged lines or tubing; weak batteries).

Spare and replacement parts stored in the field to minimize downtime include the following:

- Appropriately sized batteries
- Extra pre-cleaned sample bottles
- Locks
- Calibration solutions for each meter

Backup instruments and equipment should be available on-site or within one day's shipment to avoid delays in the field schedule.

Section 13
Specific Routine Procedures Used to Assess Data Precision Accuracy and Completeness

13.1 Laboratory Data Quality Assessment

The RMT Laboratory Coordinator and QA/QC Coordinator will oversee data validation.

The quality of the laboratory data will be assessed by the Laboratory Coordinator using CLP protocol-specific criteria, validation methods described in Section 9 of this QAPP. Data qualifiers described in the document, if applied to the data, may be added as lower case letters to distinguish them from upper case qualifiers added by the laboratory. The Laboratory Coordinator will check that data packages include a narrative to document variations from the analytical protocol and actions taken by the laboratory to address those variations. The Laboratory QA/QC Coordinator will advise the Project Team of data having questionable or unacceptable quality and procedural deviations noted in the laboratory report narrative.

13.2 Field Data Quality Assessment

To assist in collecting field data accurately and correctly, the Field Coordinator will issue specific instructions to personnel involved in field data acquisition. At the end of each field event the Field Coordinator will review the field books used by project personnel to check that tasks were performed as specified in the instructions. Field books will be reviewed periodically throughout the entire project.

Raw data and reduced data will be submitted by project personnel to the RMT Technical Coordinator for review. Equations, calculations, data transfers, consistent units, and significant figures will be subject to this Quality Assurance review.

Section 14
Corrective Action

Corrective actions may be required for two classes of problems: 1) analytical and equipment problems and 2) nonconformance problems. Analytical and equipment problems may occur during sampling and sample handling, sample preparation, laboratory instrumental analysis, and data review.

If a nonconformance with the established quality control procedures in this QAPP is identified, it will be noted in the logbooks, and corrected in accordance with the QAPP. For noncompliance problems, a corrective action program will be determined and implemented at the time the problem is identified and reported. The person who identifies the problem is responsible for notifying the appropriate field or laboratory personnel. The laboratories will communicate analytical problems to the RMT Technical Coordinator or the RMT Laboratory QA/QC Coordinator. Implementation of corrective action will be confirmed in writing through the same personnel. Field corrective actions will be reported to the RMT Technical Coordinator, implemented, and documented in the field logbook. The RMT Technical Coordinator will report any corrective action that directly impacts project data quality objectives to the USEPA Region II and NJDEP Project Managers.

14.1 Field Measurement Corrective Action

Technical staff and project personnel will be responsible for reporting technical or QA nonconformance or suspected deficiencies of an activity or issued document by reporting the situation to the RMT Field Coordinator or designee. If it is determined that the situation has impacted the quality of the data, a nonconformance report will be completed by the RMT Field Coordinator and distributed to the appropriate personnel. The field staff, in conjunction with the RMT Field Coordinator, will recommend a corrective action. The RMT Field Coordinator will be responsible for ensuring that corrective action for nonconformance has been implemented. The RMT Field Coordinator will be responsible for the following:

- Evaluating all reported nonconformance
- Controlling additional work on nonconforming items
- Determining future action to be taken
- Noting nonconformance in the field logbook
- Reviewing nonconformance reports and corrective actions taken
- Ensuring that nonconformance reports are included in the final project files

If appropriate, the RMT Field Coordinator will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed.

14.2 Laboratory Corrective Action

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken is somewhat dependent on the analysis and the event. Corrective action in the laboratory may occur prior to, during, and after the initial analysis.

A number of conditions, such as broken sample containers, multiple sample phases, low/high pH readings, or potentially high-concentration samples may be identified during sample log-in or just prior to analysis. The corrective action program is under the supervision of the STL Laboratory QA Manager. Following a consultation with laboratory scientists and technicians and team leaders, it may be necessary for the STL Laboratory QA Manager to approve the implementation of corrective action. Some conditions during or after analysis may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, automatic reinjection/reanalysis when certain quality control criteria are not met, etc. Corrective actions may be necessary if any of the following occur:

- QC data are outside the warning or acceptable windows for precision and accuracy.
- Blanks contain target analytes above acceptable levels.
- Undesirable trends are detected in spike recoveries or the RPD between duplicates.
- There are unusual changes in detection limits.
- Deficiencies are detected by the Laboratory during internal or external audits or from the results of performance evaluation samples.
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure that was used for possible errors, and checks the instrument calibration, spike, and calibration mixes, and the instrument sensitivity. If the problem persists or cannot be identified, the matter may be referred to the laboratory team leader, and/or the Laboratory QA Officer for further investigation. Documentation of the corrective action procedure, whether resolved or not, is placed in the Laboratories project file. The laboratory will provide documentation as to what, if any, corrective actions were initiated concerning this study and report them to the RMT Laboratory QA/QC Coordinator and/or include descriptions of the corrective action(s) in the analytical report narrative.

14.3 Corrective Action During Data Validation and Data Assessment

Data validation corrective actions typically consist of requesting corrections to laboratory reports. The RMT Laboratory QA/QC Coordinator will notify the respective laboratory of incomplete or erroneous reports and will request the issuance of corrected versions. Final summary data tables will not be issued until all data have been validated and all corrections have been made.

The Laboratory QA/QC Coordinator will review the data from the analysis of field, trip, rinsate, and analytical method blanks. If excessive contamination (*i.e.*, levels above allowable limits set within the applicable analytical protocols) is found in the blanks, corrective action will be taken, including requesting that the analytical laboratory:

- Check raw data and calculations, and
- If the contaminating analyte is also present at high levels in field samples, repeat the analysis of the laboratory stored sample or sample extract.

If the contamination does not appear to originate at the laboratory, the Laboratory QA/QC Coordinator, in conjunction with the RMT Technical Coordinator, will review field sampling procedures to determine if a change in field sampling protocol is necessary.

The objective for completeness is 95 percent. If samples or data are lost during sampling and analysis activities, corrective actions will be taken, including:

- Requesting that the analytical laboratory reanalyze stored samples or extracts, if available, and
- Repeating collection and analysis of groundwater samples.

Section 15
Quality Assurance Documentation to USEPA

The RMT Technical Coordinator, in conjunction with the Field Coordinator and Laboratory QA/QC Coordinator, will submit a project status report each month. This report may include the following types of information relating to Quality Assurance Activities:

- Significant irregularities noted in the field notebook during the sampling procedure.
- Results of performance and system audits, if conducted.

QA/QC data generated by the laboratory and a case narrative will be included in the CLP data packages.

Pertinent quality assurance documentation will be submitted to the following person at USEPA and NJDEP:

Addressees:

Mrs. Gwen Zervas
Case Manager
NJDEP
Bureau of Federal Case Management
Division of Responsible Site Party Remediation
CN028
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Section 16
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Attachment 1
Low-Flow Sampling Methods

Introduction

This appendix summarizes methods that will be used to collect representative groundwater samples for chemical analysis. Equipment and techniques that will be followed to purge and to obtain samples are discussed in detail. This section includes excerpts from the Wisconsin Department of Natural Resources Groundwater Sampling Desk Reference, WDNR PUBL-DG-03796 (September 1996) that deal specifically with low-flow sampling methods.

Wells That Do NOT Purge Dry

This section applies to wells that take less than ~1 hour for the water level in the well to recover (or nearly so) after they have been purged.

The following purging and sampling procedures will be used for wells that do not purge dry. The first procedure listed consistently yields the ***highest level of data quality***. The last procedure listed may yield a ***lower level of data quality***:

A. **Low-flow purging < 1 L/min (0.26 gpm), low-flow sampling < 300 ml/min (0.3 L/min or 0.1 gpm) and the monitoring of indicator parameters for stability in a closed flow-through cell.** To obtain the highest-quality, most representative, and consistent groundwater quality measurements and analytical data, purge the well at an average rate of 1 liter/minute (L/min) or less, sample at an average rate of 300 ml/min (0.3 L/min) or less and monitor indicator parameters in a closed flow-through cell until their stability is reached. This procedure will be enhanced by using a dedicated pumping system (left in the well "permanently").

   Purging and sampling rates should be at or less than the natural flow conditions existing in the aquifer influenced by the well. Drawdown during purging should be minimal and the water level in the well should stabilize before the flow rate is decreased to 300 ml/min or less to commence sampling. While maintaining a sampling flow rate of 300 ml/min or less, the water level should be stable or preferably recovering as samples are collected (this ensures that any remaining stagnant water above the pump is not incorporated into the water collected for samples).

   Do <u>not</u> reduce a pump's flow rate by using valves. The resulting pressure drop across the valve (also known as an "orifice effect") can alter sensitive samples, usually by degassing.

Purge the well until at least three consecutive readings, spaced ~2 minutes or ~0.5 well volumes or more apart, are within the following indicator parameter ranges:

Dissolved Oxygen	±0.2 mg/L
Specific Conductance	±5.0 µmhos/cm for values < 1000 µmhos/cm ±10.0 µmhos/cm for values > 1000 µmhos/cm
pH	±0.1 pH units
Temperature	0.1°C
Turbidity	< 5 NTUs (**Required** if metals samples will not be filtered. **Recommended** if sorptive compounds or elements are collected. **Optional**, but recommended if other compounds or elements are collected)
Eh **(optional)**	±30 mv

Stable dissolved oxygen, specific conductance and turbidity readings are considered the most reliable parameters for indicating that stagnant water has been replaced by formation water. You may adjust the ± ranges and indicator parameters used to indicate replacement to reflect site-specific data, geochemistry, and hydrogeologic conditions.

Turbidity stabilization and NTU readings below 5 are required if metals samples will not be filtered. Low turbidity readings (*i.e.*, < 5 NTUs), when measured using low-flowing pumping techniques, should represent colloids and particulates naturally mobile in groundwater under natural flow conditions. Turbidity stabilization should also be monitored when collecting sorptive, hydrophobic, or high octanol-water partition coefficient (Kow) compounds or elements.

Or: Purge the well until the readings for each indicator parameter listed above vary within ± 10 percent, over three or more consecutive readings spaced ~2 minutes or ~0.5 well volumes or more apart.

Collect samples from the pump's discharge line before the water enters the flow-through cell. Air pockets in the flow-through cell and probes inserted into the flow-through cell can degrade sample water quality. Either disconnect the sample tubing from the flow-through cell before collecting samples or connect a "tee" junction with an on/off sampling valve between the well and the flow-through cell to collect samples.

Low-flow purging/sampling may not be necessary or may be impractical under the following circumstances:

- Well purges dry before indicator parameters stabilize.
- Parameters are not affected by aeration, agitation, or the gain or loss of dissolved gasses (and subsequent change in sample pH, etc.).
- Data quality objectives for a project do not require the level or rigor and stringency inherent in low-flow purging/sampling.
- An alternative purging and sampling technique has been proven to meet the data quality objectives for the project.
- Procedures are extremely burdensome and time consuming.

B. **Purging FOUR well volumes and then sampling with a low-flow pump.** You may use this method when stabilization of the indicator parameters is not achieved in a reasonable amount of time (2 hours). As with the low-flow purging and sampling technique, the purging and sampling rate should still be kept low and should not exceed the natural flow conditions of the aquifer, if possible. The sampling flow rate should be less than the purging flow rate.

Wells That Purge Dry

This section applies to wells that take ~1 or more hours to recover (or nearly so) after they have been purged dry (or nearly so).

Ideally, sample and purge wells at flow rates at or less than the natural flow conditions in the aquifer influenced by the well. Drawdown and turbidity during purging and sampling should be minimal; however, for wells that recover slowly, attaining little drawdown and low turbidity may be nearly impossible. Slowly-recovering wells should still be purged and sampled with minimal disturbance to the water and fines in and around the well and to obtain samples with the lowest turbidity and oxygenation possible.

For slowly-recovering wells that purge dry, bail or pump the well dry, or nearly so, and allow it to recover at least once before collecting samples. If time permits, purge the well a second time. If recovery permits, collect samples from the well within 24 hours of the final purging.

If you are collecting sensitive samples such as VOCs and trace metals, the following procedure should yield samples with the highest data quality. Purge the well dry, or nearly so, using a very low purging rate (< 300 ml/min or 0.1 gpm). Allow the well to recover, or nearly so, at least once before collecting samples. If time permits, purge the well a second time and collect samples within 24 hours. Low-flow pumping should minimize the disturbance of fines in and around the well during purging and sampling and should therefore minimize sample turbidity.

Sample Collection

During sampling, primary objectives and considerations include minimizing sample disturbance, avoiding sample exposure to air and extraneous contamination, and preserving sample integrity throughout collection.

Collect sample parameters in the following order:

1. Unfiltered samples for in-field water quality measurements (not necessary if down well or flow-through cell measurements are taken).
2. Volatile organic compounds (VOCs).
3. Non-filtered, non-preserved (*e.g.*, sulfate, chromium VI, mercury, semi- and non-volatiles, pesticides, PCBs).
4. Non-filtered, preserved (*e.g.*, nitrogen series [ammonia, nitrates, nitrites, etc.], phenolics, total phosphorous, total metals, cyanide, total organic carbon).
5. Filtered, non-preserved (*e.g.*, dissolved chromium VI).
6. Filtered, preserved immediately (*e.g.*, dissolved metals).
7. Miscellaneous parameters.

Collect sulfate samples before sulfuric acid preserved samples (*e.g.*, nitrogen series). Collect nitrogen series samples before nitric acid preserved samples (*e.g.*, boron, dissolved metals). This will prevent accidental contamination of a sample with a preservative intended for another sample (*e.g.*, sulfuric acid preservation contaminating an unpreserved sulfate sample).

Before opening and filling sample containers, check the sampling area for potential sources of extraneous contamination. Make sure the area around the well is clean and that contaminated equipment is kept away from the well. Protect the samples from airborne contaminants such as engine exhaust, blowing dust and organic fumes (*e.g.*, gas cans); sample upwind of these contaminants or remove them before sampling. Choose gloves appropriate for the contaminants you encounter. Change into new, clean gloves every time you sample a new well or suspect your gloves have become contaminated. Do not attempt to decontaminate or reuse gloves; use disposables.

Do not open sample containers until it is time to fill them. Immediately after filling a sample container, if you haven't already done so, add any required preservative—filter first, if required—replace the cap, label the container and place the sample on ice in a cooler. Following these procedures will help minimize sample turbulence, agitation, volatilization, degassing, atmospheric exposure, biodegradation, and exposure to extraneous contamination and heating of samples.

Attachment 2
X-Ray Fluorescence (XRF) Methods

NITON Corporation

XL-309

&

700 series

User's Guide Version 5.0 (HTML) Chapter 3

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3: Analyzing bulk samples

Overview

The NITON XL-309 may be used to test lead in soil and ground-up paint chips if equipped with optional Lead In Soil Analysis software and hardware. 702, 702-A, 703 and 703-A Model Spectrum Analyzers are multi-element analyzers for bulk media, thick samples of materials such as soil, sludge, and various liquids. Applications include:

- in-situ soil testing,
- in-situ materials testing (e.g., contaminated concrete)
- bagged soil sample testing
- testing sludge, sediments, liquids, and dust in cups,
- testing prepared soil samples.

Choose the **Bulk Sample mode** from the **Setup screen (Figure 3.01)**.

Note: Before testing in Bulk Sample mode, turn your NITON on at least 15 minutes prior to

testing. This will give you more precise measurements.

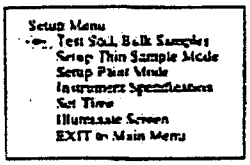


Fig. 3.01 Setup Menu
Test Soil, Bulk Samples

In general, testing methods for bulk media are of two types: Field screening and testing prepared samples. Understanding the difference between these two types of analysis is crucial to getting good data.

Field screening should be used to profile an area, to locate sources of contamination, to determine the boundaries of contamination, or to gather data that will subsequently be used to design a sampling plan. Field screening is usually only approximate; field screening will correlate very well with lab analysis for a highly-homogeneous sample, but may correlate extremely poorly for a non-homogeneous sample.

Note: For performance evaluation of field XRF results by comparing them to laboratory results (done to justify XRF usage), never use in-situ testing; always gather samples and prepare them before testing.

When comparing field screening to laboratory analysis, try to compare the same samples. For best results, collect a large sample in a zipper locking storage bag. Shake the bag to mix the sample. Test the bagged sample several times using the NITON and average the readings. Then compare this average reading with lab results.

If you must test in-situ for performance evaluation, take several XRF readings bracketing a spot. Then take a sample for laboratory testing from that spot. For further discussion of field screening, see EPA Method 6200, "Field Screening Using a Field-Portable XRF." Contact NITON for a copy. The EPA accepts field screening using the NITON if the screening is performed using Method 6200. Most states accept EPA Method 6200.

The measurement screen

On NITON XL-309s with optional Lead in Soil Analysis, *only* lead is displayed in bulk sample testing. On 700 models, only the two highest-concentration elements are displayed (in ppm, with the two-sigma confidence intervals) on the first **Measurement screen (Figure 3.02a)**, with the x-ray spectrum. The black bars on the spectrum display highlight the presence or absence of lead or iron in the sample. The test time is also displayed in nominal (source) seconds.

The summary screen

When you end a reading, the **Measurement Screen** is replaced by the **Summary Screen (Figure 3.02b)**. On 700 models, results are displayed for 14 elements. The elements are divided into two groups: elements that were detected in the sample, and elements that were not detected. Press the **Arrow buttons** to scroll through the elements.

Detection Limit: For an element to be detected by the NITON in a given sample, the measured concentration of the sample must be at least three times the standard deviation of the measurement. This detection limit will depend on the composition of the sample.

Precision: The measurement precision for each element displayed appears to the right of the measured concentration, under the heading "+-". The **precision** of each measurment is two times the standard deviation (sigma). An element is classified **detected** if the measured concentration (in ppm) is at least 1.5 times the precision.

Detected elements are displayed as in the Measurement screen. Non-detected elements are shown as **< xx**, where **xx** is the detection limit for that sample. The detection limit for each element is calculated from each sample.

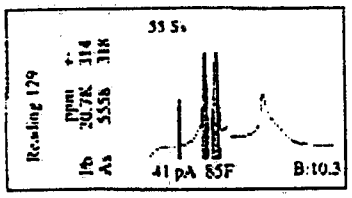


Fig. 3.02a Measurement Screen Bulk Mode. In-progress screen.

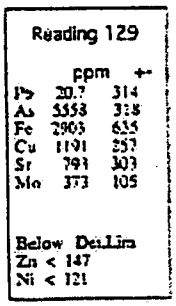


Fig. 3.02b Bulk Mode Summary Screen

In-situ surveys

Before you take your first measurement, you must decide whether to test the bulk material

- in-situ (in-place),
- as bagged samples (or, for liquids and sludge, in cups) with a minimum of preparation, or
- in an XRF cup after careful preparation.

Note: More sample preparation (drying, milling and sieving) will yield greater accuracy. The drier, finer, and more homogeneous the particles, the better the measurements.

If you are primarily interested in determining whether an element is present (rather than in accurately measuring how much is present), direct measurement is the quickest, simplest way to proceed. Even if you intend to take samples, preliminary direct measurements will help you to survey the site. The analysis of bagged samples is another screening technique.

The NITON test guard

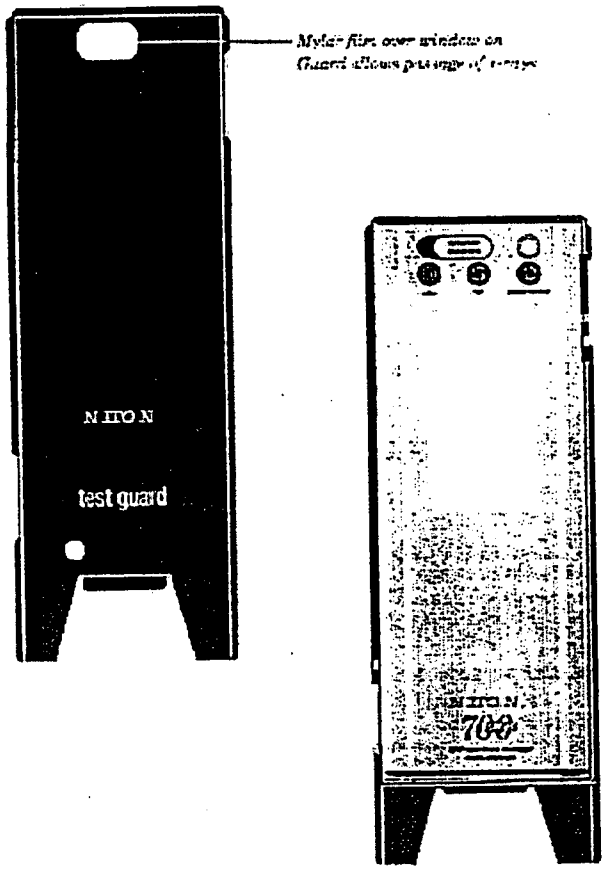


Fig. 3.03
The NITON
Test Guard

The NITON **Test Guard** (**Figure 3.03**) is a formed metal plate designed to be placed directly between the ground or other bulk media and the NITON. Use the **Test Guard** for surveys of bulk media *in-situ* or for testing bulk samples in bags. The **Test Guard** shields the unit from contamination and damage.

Testing in-situ

Warning: When taking samples from a site where toxic chemicals may be present, always use gloves and respiration equipment for your own protection.

1. Select a measurement site. Lead-in-soil from paint, for instance, will be concentrated within a few feet of the painted structure. Valid results will depend on a sufficient and appropriate selection of sites to sample.

2. Clear any surface debris or vegetation. Use a flat area so that the NITON will contact the test medium. The finer and more homogeneous the material, the more accurate the measurement. (You can increase your accuracy when testing soil by loosening the soil and letting it dry in the sun before testing.)

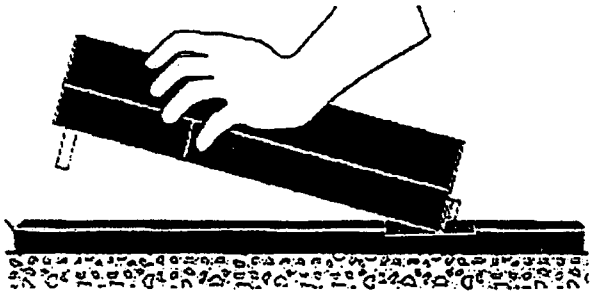


Fig. 3.04a
Place your NITON on the Test Guard

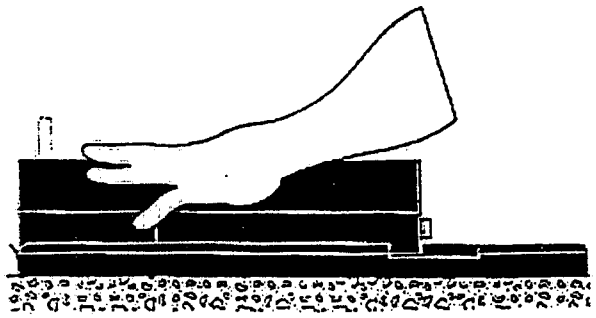


Fig. 3.04b
Firmly press your NITON flat against the surface.

3. Place the test guard on ground. Keep the top of the test guard clean.

4. Hold the NITON in one hand.

Warning: Always treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring. Never point the NITON at yourself or anyone else when the shutter is open.

5. Push the safety slide (that locks the shutter release) out from under the shutter release. If the slide is still tucked in, you cannot press in the release nor will the instrument fit on the test guard correctly.

6. Place the NITON on the test guard so that the rectangular opening on the test guard is under the window of the NITON, squeeze the shutter release, and firmly press the instrument flat against the surface of the test guard (**Figure 3.04 a,b**). If you don't squeeze the shutter release, the plunger will not depress. If the plunger is not fully depressed, the window is not fully open and the NITON cannot measure accurately. The back of the unit must be flush with the test guard.

Note: During the measurement, you do not need to squeeze the shutter release continuously. Hold the NITON firmly against the test guard surface and it will continue to read. Once you lift the instrument, the plunger will back out the bottom, the shutter will close, and the test will be finished.

7. Watch for indications to decide when the test has reached the desired level of accuracy. A typical screening test will last 20-30 source seconds.

Warning: In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.

In-situ depth profiling

An XRF soil test examines only the top millimeter or so of soil. To do depth profiling, simply remove a vertical slice of soil and test several samples from different depths. Doing so rapidly yields information about the depth of contamination.

Analysis of bagged bulk samples

Analysis of bagged bulk samples

Sometimes it is convenient to collect samples in plastic bags. Without further preparation of the sample, you can screen the site by testing each bag. Because you are testing through a bag, test results will tend to be 5-10% lower than test results obtained from direct analysis.

Taking bagged samples

1. Before sampling a site, size it up for differences in soil characteristics. Valid results depend on a sufficient and appropriate selection of sites to sample. Consider the site's topography, texture, drainage, color of topsoil, and past use.

2. Take a composite sample from each predetermined area. Do not combine samples from areas with different compositions or history. **A composite sample made up of samplings from two distinctly different areas is not representative of either area.**

Mix the sample. If it is too large, reduce the sample. Some techniques for reduction and homogenization are described in the section on analysis of prepared samples.

3. Fill a clean plastic bag with 50-100 grams of soil and close it securely (with a twist tie). The accuracy of your measurements will be limited by the thickness of the plastic in the bag you use. 1 mil-thick Polyethylene bags offer a reasonable compromise between accurate readings and bag durability. Be sure to label each bag with your name and the location of the sample site.

Testing samples in bags

Shape the bag of soil to form a continuous uniform layer of at least 1 cm. (0.4 inch) thickness. Place the NITON test guard on the bag (**Figure 3.05**). Then follow testing in-situ instructions.

Warning: Do not hold bagged bulk samples in your hand during testing.

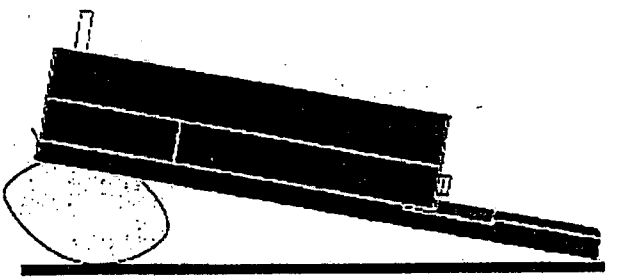


Fig. 3.05
To test a bag of soil, firmly press your NITON plus Test Guard flat against the surface of the bag (which should rest on a firm surface -- not on your hand).

Analysis of prepared bulk samples

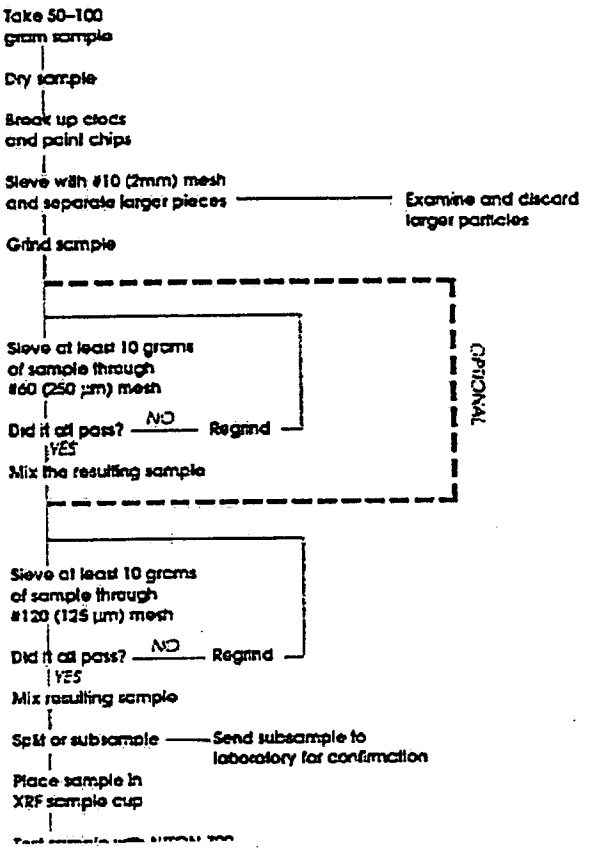
Prepared sample analysis is the most accurate method for determining the concentration of elements in a bulk medium using your NITON. Sample preparation will minimize the effects of moisture, large particle size and variations in particle size.

Warning: For your protection, when taking samples from a site where toxic chemicals may be present, always use gloves and respiration equipment.

NITON recommends a specific sample protocol. Following this protocol for preparing and testing

NITON recommends a specific sample protocol. Following this protocol for preparing and testing samples is vital for achieving a level of accuracy comparable with laboratory results. See **Figure 3.06** for a flow chart of the protocol.

Fig. 3.06 Flow chart of sample preparation protocol recommended by NITON
Use of the #60 mesh sieve is optional.



Take 50-100
gram sample

Taking bulk samples

Note: When testing for lead-in-soil in a residential setting, it is standard practice to sample the top 4 to 6 inches of soil.

The soil probe or sampling tube is a very convenient sampling tool. It not only allows speed but it makes more accurate composite samples than any other tool as it may always be inserted to a marked depth and it removes the same amount of soil at each insertion. There are core sampling devices that remove an intact cylinder of undisturbed material.

A shovel, spade, dibble, narrow (1-1/2 inch) garden trowel, or other sampling tool can do the job. Take a half-inch soil slice. A satisfactory soil auger may be made by welding a 1-1/4 or 1-1/2 inch wood bit into a 1/2 inch pipe equipped with a T-handle.

Take 50-100 gram sample to insure that you have a sample large enough to be representative and unbiased after mixing, grinding, and straining it.

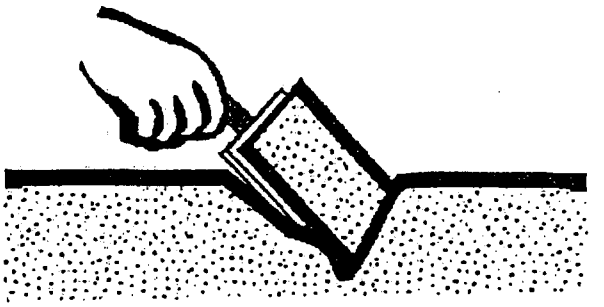
1. Before sampling a site, evaluate it for differences in soil characteristics. Valid results depend on a sufficient and appropriate selection of sites to sample. Test results may be worthless, even highly misleading, unless the samples tested actually represent the area.

Consider topography, texture, drainage, color of topsoil, and past use. Lead, for instance, is usually concentrated near a building with lead paint (within 4-6 feet).

2. If the individual samplings are taken with a spade or trowel, **(Figure 3.07)** reduce the samples by taking a vertical slice (so it is representative of the entire spadeful) about one inch wide.

Place the reduced samples in a clean pail. Then mix the sample thoroughly by stirring and by rotating the pail at an angle of 45 degrees. Don't shake. (You do not want to stratify the sample by weight).

Fig. 3.07
Use a spade, trowel or garden dibble to take a half-inch thick slice of soil



3. Take a composite sample from each predetermined area. Do not combine samples from areas with different compositions or history. A composite sample made up of samplings from two distinctly different areas is not representative of either area.

From each predetermined area, prepare a composite sample by taking several samplings consisting of vertical columns of material approximately 1 inch in diameter. The length of each column should be about 6 inches. Lead from paint is usually concentrated within the top 1-4 inches. The elements you wish to measure and the local history will determine how deep you need to sample.

wish to measure and the local history will determine how deep you need to sample.

Package samples from the following areas separately: samples close to painted structures, close to roads, samples close to where various types of waste have been stored, or near pressure-treated lumber.

4. Fill a clean plastic bag and close it securely (with a twist tie). Be sure to label it with the date, the site and the location where you took the sample

Preparing bulk samples

The equipment you need to prepare samples is included in your kit. Among these are a mortar and pestle (for the XL-309 with lead-in-soil-analysis), an electrically powered grinding mill (included with 700s), and several sized-sieves.

Caution: Keep all test equipment clean to prevent contaminated samples.

The mortar, pestle, and grinding mill may be cleaned with dry paper towels. Water will also clean the mortar, pestle, and the mill's container, but be sure each is absolutely dry before you use them on another sample. The mortar and pestle may be cleansed by grinding clean dry sand in the mortar. Use the short bristle brushes (included in your Bulk Testing Kit) to clean the sieves. When Soil Grinder blades wear out, unbolt the worn blades and replace.

Cone and quartering

At various times while preparing a sample you may need to divide it. Cone and quartering is a method for splitting the sample into homogenous quarters. Slowly and carefully pour the dry material onto a flat sheet or pan forming a symmetrical cone. Using a flat thin-bladed tool, such as a knife or ruler, divide the cone into equal piles. Divide these in half again. Now you have four samples, each one-quarter the size of the original and each more homogenous than the original.

1. If the sample is moist and cohesive, dry it. To best prepare a sample for presentation to the XRF, the material should be dry and well homogenized. Ideally, the entire sample should be dried to constant weight, sieved to remove gravel and debris, and ground or milled to a fine powder.

The sample can be dried in any of several ways. Choose one of the following: Oven dry the sample for approximately 2 hours at 150° C., until the sample reaches a constant weight; air dry the sample overnight at room temperature in a shallow pan; gently stir and warm the sample in a pan over a hot plate or burner.

Oven drying is inappropriate when volatile compounds may be present in the sample. For example, lead present as tetraethyl lead would be driven off by the heat of drying. Some forms of mercury and

arsenic are volatile. Air drying will preserve more of these volatile substances.

2. Grind the sample to break up dirt clods and/or paint chips.

3. Sieve with the #10 (2mm) mesh and separate out the larger pieces (stones, organic matter, metallic objects, etc. Examine the larger particles by eye (look for paint chips), but do not include in the sample.

4. Grind the sample so its particles will be finer and more homogenous. Use mortar and pestle, or an electrically powered grinding mill.

Warning: Grinding-and-sieving dried samples produces dust. Even clean soil contains silica, which may be hazardous when airborne. Prepare all samples in a ventilated area; wear a mask, gloves, and an apron; and spread a drop cloth.

5. Sieve at least 10 grams of the sample through #60 (250 um) and #120 (125 um) mesh. Re-grind the unpassed material until the required fraction is able to pass.

6. Mix the resulting sample.

Putting the sample in an XRF sample cup

The container holding the sample affects the accuracy of the measurement. Use a container with as thin-walled a window as is convenient and use the same kind of container and window for each sample. Consistency and careful attention to detail are keys to accurate measurement.

Note: The sample container should be a sample cup of a type that can be filled from the rear; that is, the side opposite the window (e.g. Chemplex #1330). NITON recommends using a 1/4 mil mylar film window (Figure 3.08). A supply of cups and windows are included.

1. Place a circle of mylar film on top of an XRF sample cup. The window goes on the end of the cup with the indented ring. Note that the window may be prepared ahead of time.

2. Secure the film with the collar. The flange inside the collar faces down and snaps into the indented ring of the cup. Inspect the installed film window for continuity and smooth, taut appearance.

3. Set the cup, window-side down, on a flat surface. Fill it with at least three grams of the prepared sample (no more than half-full). Take care that there are no voids or layering.

4. Placing the cup film-side down on a flat surface, tamp the sample into the cup. The end of the pestle makes a convenient tamper. If you intend to re-use the sample, you can, alternatively, place a filter-paper disk on the sample before tamping it.

5. Fill the cup with polyester fiber stuffing to prevent sample movement. Use aquarium filter or pillow filling as stuffing. A small supply of stuffing comes with your bulk sample kit.

6. Fasten the cap on the cup (**Figure 3.09**). Using an indelible pen, write an identifying number on the cup. Keep a record of the sample number, the site and location, the date of the sample, and any other relevant comments.

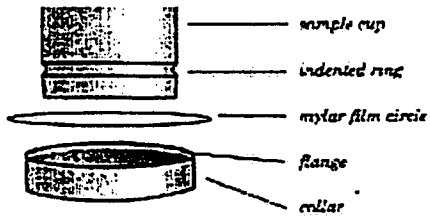


Fig. 3.08 Secure the film by snapping the collar on to the cup.

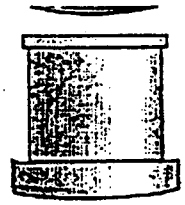


Fig. 3.09 Fasten the cap on the cup.

Preparing samples of liquids, sludges or dust

Liquids:

Fill an XRF sample cup with the liquid to be tested (Use no cotton). It is best if some overflows when the cap is put on, since the cup must be full.

Sludge:

Sludge can be placed directly in an XRF cup for screening. This is considered in-situ testing because no attempt has been made to prepare the sample. For more accuracy, the sludge can be dried, sieved, and ground.

Screening dust:

Use large dust samples taken from a home vacuum cleaner bag. Remove fibers, hairs, and debris. At least three grams of dust are needed to assure accurate analysis. Samples as small as one or two grams may be measured with less accuracy. Even smaller samples (0.3 to 1.0 grams) can be analyzed by applying a weight correction factor and by using a funnel to place the sample in the center of the sample cup.

Prepare in an XRF sample cup and test the same way you would with a soil sample. For risk analysis, it is advisable to use a 60-mesh sieve to isolate and test only fine particles.

The bulk testing platform

The test platform (**Figures 3.10a,b**) is an accessory fixture for holding bulk samples (such as soil or ground paint chips) in standard film-window XRF cups. This fixture snaps quickly and securely to your NITON instrument.

The platform latch screws underneath for storage. Before using the test platform, unscrew the latch and rescrew it on the end of the platform nearest the receptacle for the sample cup.

The test stand securely holds the XRF sample cup in place.

Testing the sample;

Set the NITON test platform on a flat, solid surface. Place the sample cup in the receptacle of the sampler. Included in your kit are some foam disks that you can put in the receptacle under the cup for firmer contact between the NITON and the sample cup window. Attach the NITON to the test stand and follow in-situ bulk sample instructions (**Figures 3.11 a,b**).

Fig. 3.10a
The Niton
Test Platform

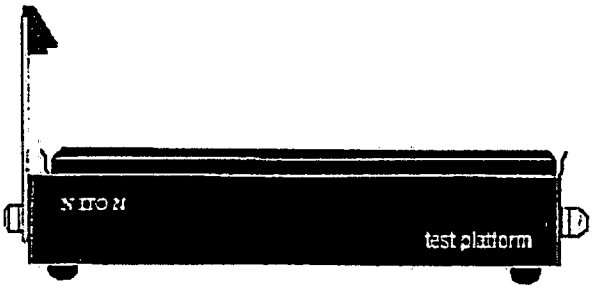
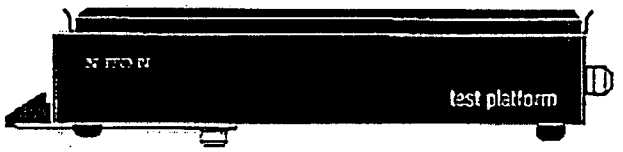


Fig. 3.10b
The Niton
Test Platform
with its latch in
the stored position.



NITON Back to the Table of Contents

Attachment 3
Chain of Custody Form

STL EDISON
777 New Durham Road
Edison, New Jersey 08817
Phone: (732) 549-3900 Fax: (732) 549-3679

CHAIN OF CUSTODY / ANALYSIS REQUEST

PAGE ___ OF ___

Name (for report and invoice)	Samplers Name (Printed)	Site/Project Identification
Company	P.O. #	State (Location of site): NJ: ☐ NY: ☐ Other:
		Regulatory Program:
Address	Analysis Turnaround Time Standard ☐ Rush Charges Authorized For: 2 Week ☐ 1 Week ☐ Other ☐ _____	ANALYSIS REQUESTED (ENTER "X" BELOW TO INDICATE REQUEST)
City State		
Phone Fax		

Sample Identification	Date	Time	Matrix	No. of Cont.												LAB USE ONLY Project No: Job No: Sample Numbers
Preservation Used: 1 = ICE, 2 = HCl, 3 = H_2SO_4, 4 = HNO_3, 5 = NaOH					Soil:											
6 = Other _____, 7 = Other _____					Water:											

Special Instructions_____ Water Metals Filtered (Yes/No)? _____

Relinquished by	Company	Date / Time	Received by	Company
1)		/	1)	
Relinquished by	Company	Date / Time	Received by	Company
2)		/	2)	
Relinquished by	Company	Date / Time	Received by	Company
3)		/	3)	
Relinquished by	Company	Date / Time	Received by	Company
4)		/	4)	

Laboratory Certifications: New Jersey (12028), New York (11452), Pennsylvania (68-522), Connecticut (PH-0200), Rhode Island (132)

Attachment 4
Laboratory Bottle Label

STL EDISON
a division of Severn Trent Laboratories, Inc.
777 NEW DURHAM ROAD
EDISON, NJ 08817
(732) 549-3900

PROJECT NAME/CLIENT		
SAMPLE LOCATION/DESCRIPTION		
TEST PARAMETERS		
CONTAINER NO.	PRESERVATIVE	
DATE	TIME	SAMPLER'S INITIALS

Appendix B
Health and Safety Plan & Hazard Assessment

The proposed scope of work will follow the health and safety procedures outlined in the documents included as appendices to the following reports:

1. *Site Health and Safety Plan* (RMT, February 1997) – Included as Appendix C in the report entitled *Remedial Action Plan Phase I Free Product Recovery* (RMT, February 1997).

2. *Health and Safety Plan/Hazard Assessment* (RMT, October 2000) – Included as Appendices C and D, respectively, in the workplan entitled *Further Off-Site Groundwater Investigation at MW19/Hot Spot 1* (RMT, October 2000).

Additional heath and safety plans and procedures will be provided as ongoing site work dictates.

Appendix C
Emergency Points of Contact

L.E. Carpenter & Company
170 North Main Street
Wharton, New Jersey

EMERGENCY NOTIFICATION

IN CASE OF AN EMERGENCY, PLEASE CONTACT THE FOLLOWING PARTIES

- **L.E. Carpenter & Company.**, On-Site Contact
  Mr. Ken Redcliff; (973) 366-9577 main; (973) 254-0022 pager

- **RMT, Inc.**, 222 South Riverside Plaza, Suite 820, Chicago, IL 60606
  Function: Environmental Project Management and Engineering
  Project Manager: Mr. Nicholas J. Clevett
  (312) 575-0200 Phone
  (312) 575-0300 Fax
  email: Nicholas.Clevett@rmtinc.com

- **L.E. Carpenter & Company.**, 33587 Walker Road, Avon lake, OH, 44012
  Function: Client
  Point of Contact: Mr. Cristopher R. Anderson
  Position: Director of Environmental Affairs
  (440) 930-1334 Phone
  (440) 930-3034 Fax

- **New Jersey Department of Environmental Protection (NJDEP)**
  Function: Regulator
  Point of Contact: Mrs. Gwen Zervas, Case Manager
  (609) 633-7261 Phone
  (609) 633-1439 fax

- **United States Environmental Protection Agency: USEPA Region II**
  Function: Regulator
  Site Contact: Mr. Steven Cipot, Case Manager
  (212) 637-4411 Phone
  (212) 637-4429 fax